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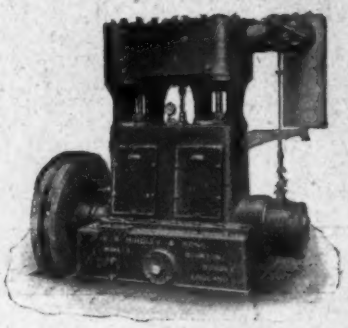

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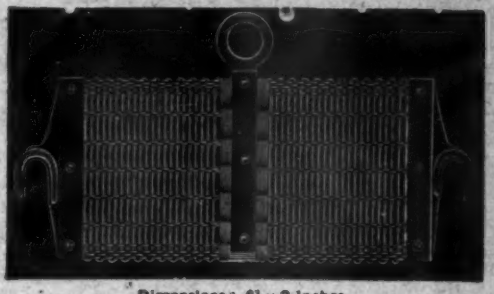

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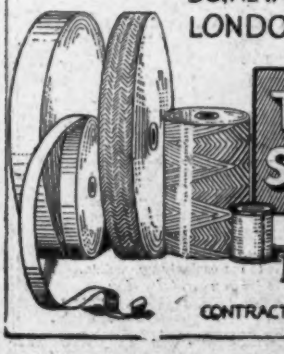

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THE

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ELECTRICAL REVIEW.

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BRITISH WATER-POWER.

ELSEWHERE in this issue we reproduce in abstract a paper read before the Royal Society of Arts by Mr. Alexander Newlands, who for a long time has taken a deep and practical interest in the utilisation of British water-power, and has now provided us with a most useful mass of information on this subject, thus rendering a valuable service to the public. We do not wish to over-rate the importance and magnitude of the water-power resources of these islands, and the author himself exhibits native caution in his calculations and estimates; but we fully agree with him, and with some of the speakers in the discussion—amongst whom was Mr. W. M. Morrison, general manager of the British Aluminium Co., Ltd., the largest users of water-power in this country—that much can be done to utilise such resources as we possess for the supply of power to industries established near the localities where they exist, particularly on the west coast of Scotland, where the topographical conditions somewhat resemble those of Norway, with the advantage of a milder climate. Thanks to the remoteness of these districts from densely populated areas, and to the absence of any other mode of utilising the water, the rights should be obtainable at very moderate cost, and the difficulties elsewhere experienced in arranging for the flooding of a valley in order to provide adequate storage capacity should not be met with in anything like the same degree.

As for the variation in power available at different seasons, is this objection ever raised in connection with the agricultural industry, the building trade, or other staple industries of a seasonal character? At no time would the works be altogether idle, and it conveniently happens that the period of low water coincides with the season when the employés would find plenty to do in connection with agriculture, horticulture, afforestation, fishing, &c. Thus the "load factor" of the working population would be maintained at a high figure, and their prosperity would not be in any way diminished by a temporary shortage of power. In this respect, our climate offers some advantage as compared with Switzerland and other countries where the melting of the snows provides the maximum power in the summer time. Moreover, there are various industries dependent upon electrochemical processes which can be conducted on a scale depending on the power available at any time, such as the manufacture of calcium carbide and cyanamide, the fixation of nitrogen, &c., with-

out serious detriment due to a temporary relaxation of output.

We are especially pleased to note that Mr. Newlands and other speakers discussed the subject from the point of view of the public welfare, and with regard to the social benefits to be derived from the establishment of local industries in rural districts. Hitherto the one great question has necessarily been "whether it would pay," from a purely commercial point of view; that time has passed away—the war and its lessons have opened the eyes of all to the supreme necessity of "team working," of placing the national welfare in the forefront. We regret that the exigencies of space prevent us from reproducing Mr. Newlands's remarks on this aspect of the question at length, and we must refer our readers to the original paper. Our only criticism relates to a misunderstanding with regard to the recent report on Coal Conservation, which he shares with an extraordinary number of writers on these questions—namely, his statement that the Committee recommended the substitution of 16 super-power stations for the existing legion. The fact is that the Committee merely suggested the division of the country into 16 *areas*, supplied from large power stations which might number 30 or 40, if necessary, no limit being placed upon the figure; moreover, so far from each of these stations being of the inadequate output of 20,000 H.P., as he states, the Committee urges that *each* of the generating sets should be rated at *not less than* 20,000 H.P., and preferably should be of 50,000 H.P. These points, however, have little bearing upon the subject of the paper, though the fact that Mr. Newlands estimates the total available water-power of the British Isles at something like one million H.P., whilst the Committee looks forward to the addition of 15 or 20 million H.P. with the coal saved under its scheme, shows that at the best we cannot hope to supply more than a small fraction of our power requirements from water power.

In this connection it is worth remembering that the cost of energy from water power is practically fixed by the capital charges; that is, that it costs little more to supply a 24-hour load than a 1-hour load of the same KW. rating. Hence the value of water-power to industry ought to be estimated not on the KW. capacity of the generating plant, but on the aggregate output in KW.-hours. It should also be borne in mind that when farmers realise the value of the assistance that they can derive from electric power, the small water powers that are scattered about the country will be well worth development for agricultural purposes.

In conclusion, while we are here concerned with British water power only, let us not lose sight of the immense resources of the Empire in this respect, which ought to be, and we hope will be in future, developed by British engineers with British-made machinery. The vast scope that lies before us was briefly indicated by the author and by Sir Dugald Clerk, and we are glad to learn from the latter that the Board of Scientific Societies is collecting information on this subject, which is constantly growing in importance for many weighty reasons.

We may add that in the United States, where the water-power question has for some years been a bone of contention, the importance of finding an immediate solution to the difficulties which have delayed the development of the country's power resources has at last been realised, and President Wilson, in a message to Congress in December last, declared that it was "imperatively necessary" that legislation should be enacted to enable the water-power to be fully utilised. In accordance with this statement, the U.S. Administration has recently introduced in the House of Representatives a new measure designed to incorporate the best points of previous Bills whilst avoiding their defects, and it is anticipated that it will meet with little opposition. At a time when the shortage of coal has become acute, and transportation difficulties combined with bitterly cold weather have culminated in an unparalleled state of chaos on the railways, our American Allies are lamenting the delays which have resulted from divided counsels in their Legislature, but for which the development of their immense natural resources would have placed at their command hydro-electric power of priceless value.

The Board of Trade Tramways Committee.

AMONGST the numerous departmental committees which have come into existence during the last few months is the Board of Trade Tramways Committee, to which we briefly referred in our issues of November 15th and 23rd last. The Committee, it may be mentioned, has recently received an additional member in Mr. Jas. Dalrymple, of Glasgow, and is housed at 8, Buckingham Gate, S.W. The duties of this Committee were recently defined by the *Board of Trade Journal* as follows:—

1. To take steps to provide where necessary for the loan or transfer of rolling stock, materials or plant from one undertaking to another.

2. To determine the relative priority of the demands of various tramway and light railway undertakings for necessary materials and supplies, and to make the necessary arrangements in the matter.

3. To deal with questions of new or increased services and the maintenance of existing services, and if considered necessary to make recommendations for the closing of the traffic of any undertaking, either wholly or in part.

4. To consider the question of the construction of new lines or the extension of existing lines, and to make recommendations as to the supply of the necessary materials, plant, &c., therefor.

5. To value the materials and plant which may be released by the reduction of services or the closing of any existing lines, and to advise as to the amount of compensation payable in respect thereof, and the loss in revenue involved, if any.

6. To consider such applications for the revision of existing statutory tolls and charges on tramways and light railways as may be referred to them by the Board of Trade, and to make recommendations as to the action to be taken.

It will be seen that while the Committee is mainly concerned with materials, yet Clauses 4 and 6 confer on it powers of a wider character, in regard to the construction of new lines and revision of statutory charges, and incidentally remind us that a committee of tramway experts such as this might very well be a permanent institution, as it could at least be depended on to show a practical appreciation of the future possibilities of tramway development, and to deal sympathetically with proposals for reviving this rather dormant branch of the electrical industry.

GOVERNMENT PROPAGANDA BY TRAVELLING KINEMAS.

Villagers and townspeople in various parts of Great Britain and abroad will shortly be viewing with interest military lorries initialled B.I.D. (British Information Department), and bivouacked on village greens or market squares, or wherever else an audience may be secured for their work of propaganda by kinematograph on behalf of the British Government and its war efforts. Such work is greatly needed and much overdue, especially abroad, where it will do much to counteract the numerous activities of German agents. Members of both Houses of Parliament have recently inspected these outfits in operation, and most satisfactory results have been achieved.

Fig. 1.—The British Travelling Kinema.

Each unit is a self-contained portable picture projection set, and comprises a combined petrol engine and generator switchboard, and projector. These are mounted on the floor of the lorry, which can be drawn up at any desired spot, and with the sides opened out, is at once ready for exhibiting the "movies." The necessary screen can be hung on almost any wall of suitable height, or strung between trees or posts. If a hall is available, the projector can be taken inside, a sufficient length of cable being carried to meet any probable requirements of this kind. The switchboard is mounted immediately behind the driver's cab, and the combined bedplate for the engine and generator is fixed parallel to it, and as close to it as possible. The remainder of the floor space is thus available for the projector and resistance, and the two attendants have ample room to carry out their duties. A complete set of spare parts is carried, as well as a folding workshop bench, fitted with heavy vice, soldering equipment, and all tools needed for effecting field repairs, &c. The lorry, fully loaded, weighs 5½ tons.

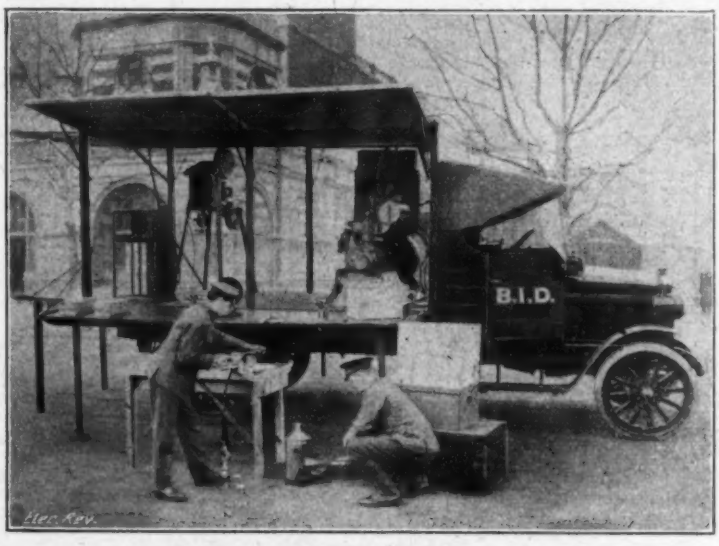

Fig. 2.—Roadside Repairs in Progress.

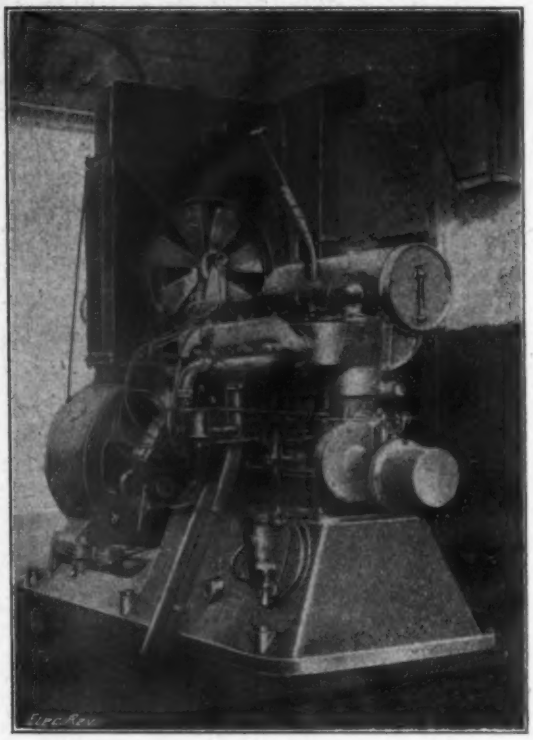

Fig. 3.—Petrol-electric Set.

The petrol engines are four-cylinder Pelapones, of 12 h.p. at 800 r.p.m., and are fitted with automatic lubrication, whilst the electrical section of the plant is of the G.E. Co.'s manufacture.

The switchboards are substantially made, and all cut-outs are provided with straps to prevent their jarring out. The generators are compound wound, with an output of 100 amperes at 70 volts, and 25 per cent. overload can be borne for two hours.

Kamm projectors of the latest model are used, with a new pattern front type drum shutter. The tests have proved that the pictures shown from the body of the lorries are as rock-steady as those of any modern picture hall. When it is remembered that the generating plant for the projector are is working on the same floor as the projector itself, and that the whole apparatus is mounted on the relatively unstable foundation of a motor-lorry body, this feature is of special interest, and evidences great care in design. It is believed that no successful results have previously been obtained with an arrangement of this kind. The lorry bodies are of roomy construction, and will act as homes for the various parties, hammocks being provided for sleeping purposes. The roof is fixed, but the sides and back are hinged. The lower halves of the latter are provided with legs, which rest on the ground, whilst the top halves are held up by compasses. The arrangement of these can be varied, therefore, to suit weather and other conditions, either by being fully opened, part opened, or totally closed. The 4-ton Vinct chassis

are fitted with special transverse bearers to take the weight and vibration of the generating plant, and four-cylinder 40-h.p. engines, with four-speed gear boxes and worm-driven back axles, are provided. The entire equipments have been completed to the design and under the supervision of Capt. J. W. Barber, of the British Information Department.

Fig. 4.—Projector in Operation, Showing Freedom from Vibration (exposure 20 seconds).

PROBLEMS OF INDUSTRY.

(*Continued from page* 105.)

The Minister of Labour (Mr. G. H. Roberts, M.P.) in a recent speech expressed the view that the state of the labour market after the war—*after the lapse of a period of reconstruction*—would be so favourable that physically fit men would experience very little difficulty in securing employment, but there must be a display of goodwill and sympathy in securing suitable employment for the disabled solder. Without universal co-operation in this matter grievances would arise.

Mr. Roberts called for "the human touch" to be applied throughout the whole system, and in respect of the discharged soldier of the unfit type it will be our bounden duty to display it. There may be difficulties with those who have never been soldiers at all in this connection, and we shall all require much discretion and a willingness to show the "human touch." Mr. Roberts holds as we do, and as Mr. Hichens undoubtedly does, that too many reformers to-day overlook the necessity of character. There are in our midst to-day, as Mr. Roberts says, men of prominence who are playing with the fires of revolution and pandering to passions—men who fail to perceive that the first essential of real progress is the elevation of the character of the whole people. On the other hand, it is satisfactory to find that there are many minds at work upon the constructive side and not a few of them agree in advocating this "human touch" in industry. Such a "touch" is found by some speakers to exist already. For example, Major Astor, M.P., finds that industry has been "humanised" and greatly changed by the development of co-operation between employers and employed. This great change, however, may not outlast the war. If we have no Prussian militarism menacing our existence that co-operation may be weakened unless the Whitley machinery be set up to give it both a measure of permanence and room for free play. Major Astor expresses the conviction that we must recognise that great changes are upon us. We must recognise it in industry. There is as much responsibility resting upon the reactionary as on the wildest of Bolshevists, for the feeding of the fires of revolution. When we say that Mr. Hichens's ideas are not to be banned on the ground of impractical idealism, we do not fail to see that all leaders of industry are not going to give them their approval either immediately or from A to Z, but they have the merit that they try to hold the balance fairly between Capital and Labour under the altered conditions of life, when the spirit of industrial domination, in so far as it is akin to Prussian militarism, has got to give way to the "human touch" of Mr. Roberts, and to the "humanising of industry" advocated by Major Astor.

Let us now turn to a review of certain steps which the Hichens principles seem to suggest in relation to certain of the outstanding problems with which industry is to-day confronted.

We print the James Watt lecturer's remarks on these points fairly fully, because we believe that only good can result from a close study of them, however much they may run counter to the commonly accepted ideas of industrial authorities. First, it is held that no business is entitled to make unlimited profits, but, of course, no business man would advocate limitation unless the limit were sufficiently high to afford such a return as to justify the investment of capital in industrials. We shall require after the war to offer fuller inducement to capital, rather than less, to come into industry, and the days that will call for the maximum of efficiency from us all will not be times to dampen down initiative in any class. The limitation might be quite possible without the unwise limitation of reward to managers and representatives responsible for progressive business policy and action. The point is what should the limit of return on capital be? You can have no fixed basis for differing businesses, and you must consider it in relation to the reward derived by the workers who so largely contribute to the earning of it, and in relation to the price to the consumer, to serve whom the business exists:—

1. The present theory is that the residum, however large it may be, after defraying the costs of production, should go to Capital. This, I submit, is unsound. Labour, the entrepreneur class, Capital and the Consumer, are all partners in the business of the community, and no one class is entitled to benefit unduly at the expense of another. The principle of the profits tax should, therefore, be retained after the war. The present tax, of course, was intended as a temporary measure, and a standard of profits based on pre-war earnings is quite unsuited to permanent conditions. It would be necessary to fix a standard rate of interest for the capital invested in each class of trade or industry, and a proportion (I suggest a substantial one) of any excess profits over that standard should accrue to the State. In any such scheme it would be necessary to provide that adequate allowances are made for depreciation and for reserves to secure the stability and development of business. The wholly inadequate provision for depreciation allowed under the income-tax regulations to-day has, I believe, done serious injury to the industries of this country. It has encouraged over-capitalisation; it has hampered the scrapping of old and the substitution of modern machinery; it has given us a retrograde in place of a progressive standard. . . . Effect must somehow be given to the principle that no section of society is entitled to an unlimited share of the wealth of the community, that free competition has proved an impossible solution, and that profit-sharing with the State which is what, in the effect, an excess profits tax is, is more equitable and more expedient than other forms of profit-sharing.

2. It follows, secondly, that just as Capital is not entitled to an unlimited reward, but must be checked by State action, so also the reward of Labour must, in the last resort, be determined by the State, as representing the community. Labour has no more right than Capital to make a corner in its own commodity and hold the community up to ransom, and it, too, must bow to the will of the State. In practice it is clear that the tendency will develop for wages to be settled by joint industrial boards representing employers' and workers' organisations, but, in the event of disagreement, or collusion to exploit the community, the State must have the right of intervention. It is not fitting that any party should be the final judge in its own cause, and any such claim, if successful, will inevitably lead to the disintegration of society. For the community will be divided into a number of groups, each fighting for its own hand, private gain will rise superior to the public good, the fundamental law of social life will be broken, and the eternal

truth will be verified that a kingdom divided against itself cannot stand. I recognise that a large section of the community is not, to-day, prepared to accept the principle of State intervention, and I recognise also that unless it appeals to the moral judgment of the great majority of the nation, it cannot be enforced, and ought not to be enforced. The important thing to-day is that the verdict of public opinion should be sought.

3. The principle of national service requires, thirdly, I submit, that the status of Labour, as a whole, should be raised. The workers are clearly entitled to have an effective voice in regard to the general conditions under which their work is carried on. They are vitally interested in all questions, for example, affecting wages, hours of labour, apprenticeship, demarcation of work, decasualisation, and they have an equal right, with employers, to assist in the determination of these problems. The general acceptance of the proposals for joint industrial councils contained in the Whitley Report, is good evidence that public opinion will support the demand of Labour for an improved status. If its voice is to be at all effective, it follows that, as suggested in the Whitley Report, District Councils and Works Committees must be established to deal with local questions, and to ensure that whatever is agreed to by the Central Councils is carried out locally. The more highly organised Employers' Associations and Trade Unions have already advanced far along the lines of the Whitley Report, but much has yet to be done in determining precisely the powers and functions of these joint central and district bodies.

In the course of his discussion of the first of these points, Mr. Hichens touches upon the causes of Labour's policy of restriction of output which has become so serious a factor at several important stages of the war. The unfair cutting of piece rates has been alluded to by us again and again as being a root cause of that reprehensible practice. We quote again :—

> The strongest justification of restriction of output is that individual firms have it in their power to cut down piece-work rates, and in the past they have often done so when they found that under them the workers were earning very high wages. Consequently, the workers have felt that in the end the result of increasing output and speeding up has been to reduce the piece-work rates and restore the normal balance of their earnings; not unnaturally, therefore, they have concluded in favour of maintaining a normal output of work. It is quite clear a mistaken piece rate must be open to revision downwards as well as upwards, and the pledge given by the Government at the beginning of the war that no piece rates should be reduced was a benevolent blunder. During the war some bad individual mistakes have been made, which have reacted on industry as a whole. It would seem, therefore, on all grounds, that the responsibility for fixing piece rates and special time rates—in other words, of the detailed interpretation of wages agreements—should rest, not on individual firms, but on the Joint District Councils which are to be linked up with the Joint Industrial Councils. This would mean that these Councils would require a competent staff of rate fixers to deal with each case promptly, but a more than corresponding reduction could probably be made in the rate-fixing staffs of individuals firms, and the gain that would result from placing the settlement of piece rates on a basis that would establish confidence is incalculable. . . . . Collective rate fixing is the logical outcome of the shop-stewards' movement which has gained recognition.

Concerning the claim that is sometimes put forward that Labour should have an effective voice, not merely in regard to the general policy and conditions of industry, but in the management of each individual business, Mr. Hichens remarks that this claim is vaguely put forward and has never been clearly thought out. He agrees that the general policy and conditions of industry should apply to each firm in an industry, and therefore it is right that Labour should have an effective voice in determining them and seeing that they are carried out, through joint industrial Councils and District Committees, but he observes that every degree of variation is possible in the detailed organisation of individual businesses, and each business should be organised on whatever lines seem best to those who are responsible for its direction. The evils of insecurity of tenure are admittedly great, and every effort should be made to remove "this nightmare of uncertainty which oppresses the wage-earning class"; but the root cause of it is "not the right of the management to employ whom it pleases, but the fluctuation in supply and demand, which can never be wholly controlled," although much more can be done than has ever been attempted. There is sound sense in the remark that: "The secret of success in business lies very largely in the wise selection of men, and if that responsibility is taken away from the management, a blow will be struck at the very roots of our industrial supremacy." We believe that this view must be considered unassailable by the reasonable leaders of Labour, though we do not expect it to carry weight with the sections who will be content with nothing less than the elimination of the employer and the complete control of industry by "the workers."

From later remarks, it is obvious that Mr. Hichens is not in agreement with the soap-bubble proposal calculated, we think, to be a source of unsettlement, of a six-hours day for Labour as a means of giving employment for all after the war. John Burns's old battle cry of "Eight hours' work and eight bob a day" finds favour with Mr. Hichens, so far as the first part of it is concerned. The times, however, have rendered the latter a very modest pittance, and they have also altered the attitude of many people toward the eight hours demand of 1897. The author regards eight hours as a first instalment toward further reductions, because it is now generally recognised that man is not a mere machine, and lengthy drudgery will not produce a healthy community with leisure for faculty development. Furthermore, our war-time experience has shown that it may be a very false economy to employ men and women after a fatigue point has been reached. Mr. Hickens would go so far as to arrange that each worker, after a year's service with good timekeeping, should have a holiday on full pay, and we believe that this idea will find favour in coming days.

(To be continued.)

WATER-POWER IN GREAT BRITAIN.

By ALEXANDER NEWLANDS, M.Inst.C.E., Engineer-in-Chief, Highland Railway.

(*Abstract of paper read before the* Royal Society of Arts.)

In this paper the author gives a large quantity of data relating to the rainfall, river discharge, ratio of ordinary to flood discharge, catchment areas, horse-power available, &c., in the British Isles, with references to many sources of information on these points. He points out that each catchment area is a problem in itself, and it is extremely difficult to generalise upon the power possibilities of a whole country even with approximate accuracy.

Scotland.—Scotland, and in particular the Scottish Highlands, being the country north of the Forth and Clyde, possesses more water power possibilities than any other part of Great Britain.

Over a considerable extent of this northern area the rainfall exceeds 60 in. per annum, and it is fairly uniform throughout the year. The country is, however, bare, largely uncultivated, and treeless, so that much of the rainfall is lost in flooding in the rivers.

From the water-power standpoint, the natural lochs, many of them of large area, and at very considerable elevation, are of extreme value. They act as regulators to the rivers in dealing with the discharge of abnormal rainfall, and, in many cases, are ready to hand for regulation and control as power dams. The Highland area under review extends to, approximately, 12,000 square miles, and the seaboard surrounding it is extremely indented and extraordinarily developed, long sea lochs running far inland, affording excellent facilities and shelter for shipping. No part of it is more than 20 miles from the sea or the Caledonian Canal.

The following table admits of comparison with the rest of Great Britain :—

Areas having 50 inches of Rainfall and over.

—	Total area.	50-inch area.	Percentage of total area.	Location.
	Sq. miles.	Sq. miles.		
Scotland...	27,413	11,575	42 %	Scottish Highlands and Southern Uplands.
England...	50,053	3,360	6·7 %	Lake and Shap Districts and Devon and Cornwall.
Wales ...	7,376	3,390	46 %	Entire Central area.
Ireland ...	32,694	5,910	18 %	Chiefly Donegal, Connemara, Killarney.

The Bathymetrical Survey of the Scottish Fresh Water Lochs is of the greatest assistance to anyone interested in the water-power possibilities of Scotland. It is much to be desired that a bathymetric survey of the inland waters of the remainder of Great Britain should be undertaken either by the Ordnance Survey Department or the Hydrographic Department of the Admiralty.

With the information available the author has endeavoured

to arrive at an approximate estimate of the water power available in Scotland by the impounding of the discharge from the loch basins, assuming an average rainfall of 42 in.

In every case a loch has been selected for regulation and control as an intake, and the drainage area of it taken as the catchment available. The fall available has been reckoned as that from the intake to the nearest point on the seaboard, or on the route of the Caledonian Canal, or nearest line of railway, these being the localities where industrial works would most readily be laid down.

Of the 42-in. rainfall it is assumed that two-thirds, or 28 in., is available for power, and the figures on the accompanying map represent the power available, assuming that the flow for 24 hours is utilised in 12 hours, the efficiency of the machinery being reckoned at 75 per cent.

If the summer flow of rivers in mountainous districts be 20 cu. ft. per minute per square mile, equal to 4½ in. of rainfall, a total of 14 in. would maintain three times the summer flow in these rivers, but evaporation and absorption would have to be met by the rainfall in excess of 42 in.

In an appendix are given the data from which the powers have been calculated. The map, the data, and the method of calculating the powers are simply an attempt to deal in a general manner with the possibilities of water power existing in the country, and to arrive at an approximate estimate of the amount of such powers.

The powers on the map total up to 375,000 H.P. in round figures. By diversion and linking-up of adjoining catchment areas, and by impounding beyond the extent provided for in preparing the estimate, it may be assumed that for, say, 100 days' supply, 650,000 H.P. is available.

In the Scottish Highlands the largest installation so far laid down is the Kinlochleven works of the British Aluminium Co.

The drainage area is the relatively small one of 55 square miles, but it has no natural reservoir within it, so that the expense of constructing a dam of a maximum height of 86 ft. and of a length of 1,037 yd. had to be faced.

The area had, however, the paramount advantage of a high elevation, the overflow sill of the dam being 1,065 ft. above Ordnance Datum, and the effective head being 920 ft. It has a further advantage in respect of its high rainfall of fully 70 in. per annum, and the water rights were bought outright.

The reservoir has a length of 7½ miles, and an average width of about half a mile. It impounds about 20,000 million gallons of water, sufficient to give an output of 30,000 H.P. for about 100 days. The cost of the works proper was £600,000, or £20 per H.P.

In 1909 Mr. Morrison, manager of the company, stated that the output of the plant was 150,000,000 units per annum. After allowing for interest and depreciation, the total cost of the energy was 0.0625d. per unit on a load factor approaching unity, or approximately, 34s. per H.P. per annum continuous working.

Having developed the power in the Leven basin the company is now asking Parliamentary authority to utilise the Laggan basin. The same company has also 7,000 H.P. installed at Foyers on Loch Ness.

As an example of a small installation, that at Raven's, near Strathpeffer, may be instanced. The water is drawn from a small dam costing little more than an ordinary farm milldam, and on a head of 600 ft. develops 120 H.P., and supplies current for lighting and power to Dingwall and Strathpeffer.

There are installations at Stanley, Blair Castle, Loch Rosque, Achnasheen, Evanton Village, Ardross Castle, Fochabers, North Esk, and elsewhere.

Attractive possibilities exist in the stretch of the Caledonian Canal between Loch Ness and Inverness. Loch Ness drains approximately 700 square miles, and the level of it is 50 ft. on Ordnance Datum. The stretch of the canal referred to is the same level as the loch, and by drawing from it such a quantity of water as would not interfere with navigation, 3,000 H.P. for the working days of the year could be got at Inverness.

Loch Luichart, near Strathpeffer, drains 149 square miles of very wet country, and has an area of 1,150 acres. The river falls 125 ft. in a length of 850 yards. Two-thirds of a 42-in. rainfall would, under these conditions, represent 6,000 H.P. on a 12-hour day basis. The outlet of the loch is a narrow rocky gorge, and impounding could be easily and cheaply carried out.

Lochs Morie and Glass, on the east shoulder of Ben Wyvis, are at elevations of 621 ft. and 712 ft. respectively, and the combined powers from them, if developed on the shore of Cromarty Firth, would amount to 12,800 H.P.

There are considerable and widely distributed possibilities of power development in many rivers and small streams all over the country. The development of small powers from suitable streams is a relatively simple and inexpensive matter. In the case of large rivers, however, it is difficult economically to utilise even a considerable part of the normal flow owing to the cost of dealing with a large volume of water on the low fall normally available. Turbines, for a head of 25 ft., cost £4 per H.P., as against £1 per H.P. for a head of 500 ft. A high fall is the ruling factor in all economically developed power schemes.

If it be assumed that 20 cu. ft. per minute per square mile be available for power, this represents .03 H.P. per foot of fall. A river like the Spey, draining 1,100 square miles, would, therefore, represent on a 15-ft. fall, requiring about a mile of power water flume, 500 H.P. On many reaches of such a river where the fall is much greater and the drainage area less, the power available would, however, be much greater, owing to impounding being possible. On certain large Irish rivers it has been calculated that 50 cu. ft. per minute per square mile is available for power.

Owing to the difficulty in arriving at total powers available directly from river flow, the map shows power obtainable from impounded areas only.

The powers shown on the map total up to 357,000 H.P., and it is believed they are arrived at on a conservative basis. Assuming that these powers are looked upon as a national asset, the development of them to their maximum efficiency should be carried out under statutory control. Unless this be done, the perpetual right to them will be absorbed by private enterprise, and so be lost for all time to the nation. It does not follow that private enterprise should not be encouraged to develop the powers, but this could be done under statutory authority whereby it would be possible for the State to acquire the powers if and when it required them for national purposes, or to buy them up altogether under a pre-arranged basis of purchase, in the same manner as at the inception of the railway movement the Government retained an over-riding interest in all railways.

Such a control could, moreover, ensure that by generating current of the same periodicity at every power station the whole of them could be made to feed into a network of transmission lines. In this way abnormal rainfall in areas widely apart could be converted into power, and not be lost.

MAP OF PART OF SCOTLAND,
showing areas having an average rainfall of 50 in. per annum or more (hatched border line) and available horse-power.

The Ministry of Reconstruction Sub-Committee recommend 16 stations of normally 20,000 H.P., or a total of 320,000 H.P., say, 400,000 H.P.—about what is shown on the map. If carried any great distance the Scottish powers would have to be reduced to, say, 60 per cent. efficiency to allow for conversion and transmission losses, but even then their total would amount to 300,000 H.P. On the other hand, it is doubtful if the cost after development and transmission to existing industrial areas would be less than the cost of power generated there at the pit-head. It may be, therefore, that the sphere of usefulness of these water powers is the region in which they are available, along with a fringe of the adjacent territory to which they could be transmitted. Scottish water power exists in a territory destitute of coal, and it is due to the presence of, or accessibility to, cheap coal that the great centres of industrial activity are located where they are. Shipping facilities also determined their location, but such facilities exist all over the northern half of Scotland.

The extent to which we have neglected the agricultural possibilities of our country is causing anxiety to reflective minds. Only 22 per cent. of the people of Great Britain and Ireland lived under rural conditions. Much of this condition of things is attributable to the centralisation of industry, which has absorbed our rural population to an increasing extent year by year.

Now we have the cry of "back to the land," and a demand for afforestation, which latter undoubtedly offers vast and far-reaching remedial possibilities. Both of these schemes

should as far as possible be associated with an industrial development, and where water-power exists this is eminently practicable.

If we are to witness the birth of an industrial-cum-agricultural era in this part of the country, it follows that sufficient Highland water power must be conserved for the purpose. Farming operations generally could well participate in the broadcast distribution of electricity for lighting and power for all the operations carried on in the field and in the farm buildings.

The real advantage of combining industry with agriculture on any scheme of land settlement is that the industrial employment supplements the living on the croft or small holding, which of itself will not provide a sufficiently remunerative and attractive livelihood.

Dr. Scott, Professor of Political Economy, Glasgow, in a report to the Scottish Board of Agriculture, strongly advocates the initiation of a scheme of home industries using power in the Highlands.

Mr. E. A. Ashcroft, speaking at the Institution of Mining and Metallurgy, says there are in the extreme north-west of Sutherlandshire, and within reach of admirable shipping facilities, 12,000,000 tons of pegmatite in intrusive veins of a total width of a quarter of a mile, ideally situated for open quarrying operations. He estimates that from a plant which he specifies 50 tons a day of 80 per cent. potassium muriate could be obtained, equal to what is obtained from all the 300 blast furnaces in the country put together. These Scottish deposits would alone suffice to maintain twice such an output for 50 years at a cost not exceeding £7 a ton, and not more than £15 to £20 a ton even under war conditions.

Graphite exists more or less freely in several localities. Molybdenite and chromite are also to be got; steatite exists in various localities, and the Skye diatomite is well known. The iron, consisting largely of brown hematite, at Tomintoul, is worth mention, and the iron deposits in Raasay are now well known. Lead ore is being worked at Georgemas, and barytas near Lybster, both in Caithness.

England and Wales.—If the figure already arrived at for Scotland be assumed correct, on the same ratio the power for the other countries would be:—

	For 12 hours' daily supply.
England	281,000 H.P.
Wales	109,000 H.P.
Ireland	359,000 H.P.

The absence of large lochs in England and Wales, and the want of elevation in the country as a whole, severely restrict the possibilities of water-power development.

The direct flow of rivers appears to be the principal source of energy available, and owing to the variation in flow, and for other reasons, no great amount of power appears to be economically available.

The Dee drains 713 square miles above Chester, and by utilisation of the old Roman weir on the river there, the yield from this catchment area is passed through turbines, and appears to develop about 500 H.P. on a fall varying from 1 ft. to 9 ft.

If the average fall be called 5 ft. the power per square mile of drainage area per foot of fall equals 14 H.P., requiring 90 cu. ft. per minute per square mile. The average flow of the Dee at Chester is given as 90,540 cu. ft. per minute = 127 cu. ft. per minute per square mile.

Ireland.—Like England, Ireland's possibilities of power appear to be principally in her great rivers.

A great part of the interior of the country is a flat plateau of varying elevation, but nowhere at any great height above sea-level. In this plateau flow great sluggish rivers which have a steep fall to the sea for the last few miles of their length. This feature of the rivers makes them extremely valuable for power production. The best of the lochs lie in flat arable or grazing country, and the raising of their level by impounding would flood much valuable territory.

Mr. Dick makes an estimate of powers from a number of rivers. The amount of power as given by him is as under:—

"Constant" power	5,916 H.P.
Ten months' power	11,832 H.P.
Seven months' power	23,664 H.P.

Mr. Dick says that the normal flow—*i.e.*, giving ten months' power—may, for areas of 30 square miles and upwards, be taken as 25½ cu. ft. per minute per square mile.

To recapitulate briefly, if we are to pay for this war by acceleration of our industrial activities, any scheme for the broadcast distribution of cheap power is of the utmost importance. Water power provides great possibilities in coalless territory and where coal cannot be cheaply imported.

Any successful policy for an agricultural renaissance must be associated with an industrial policy, and utilisation of water power and afforestation are pre-eminently attractive from this point of view.

The rural homes throughout the country are occupied by old people, maintained by their sons and daughters employed in the great cities, and unless the younger generation be found remunerative and attractive employment where they are born they will not settle down there. Moreover, the poverty of our rural districts has been for long attracting attention, and unless something be done which will increase the rateable value there, it looks as if taxation for public services, such as education, poor, roads, sanitation, &c., will eventually have to be met by the State.

In an appendix the author gives abundant data regarding the Scottish lochs, drainage areas, fall available, and power possibilities. His approximate formula for calculating horse-power is $AH/3$, where A = catchment area in square miles and H = fall utilised in feet.

In the discussion, Mr. C. S. MEIK said that in the eastern part of the Highlands 42 in. of rainfall was high, but that figure was very low indeed for the western shores of Scotland. There were districts west of the Caledonian Canal where the average rainfall was over 100 in., and at Kinlochleven, farther south, it was 86 in. It therefore followed that the water power available on the western coast would be very much more than in the interior. He did not see how small powers could be developed to advantage, especially inland, unless the power was going to be transmitted to a town. On the western shores of Scotland he thought there was every possibility of large developments in the future, because the use of power to any extent involved the conveyance of raw materials, and those materials could be conveyed much more cheaply by sea than by railway or any other means.

Mr. W. MURRAY MORRISON did not agree with Mr. Meik with regard to small powers, but thought there were a number of industries which might very well be set up to utilise smaller powers, by which he meant 3,000, 4,000, and 5,000 H.P. With regard to the employment of labour, he believed that the establishment of such installations in the Highlands of Scotland was the key to the situation which politicians had been striving to find for many years past, because it would lead to an increase in agriculture, fishing, and other industries, including afforestation, which would need serious attention after the war. He did not agree with the author's plea for the nationalisation of the water power in this country; if private manufacturers were encouraged to extend the use of water power, progress would be very much more rapid.

Sir JOHN BENTON thought the Government should make a thorough hydrographic survey of all the waterways in Scotland. Objection might be taken to nationalisation, but a proper survey of the water powers of this country must be regarded as a national question.

Major-General Sir GEORGE SCOTT MONCRIEFF thought that, although the development of water powers might be left largely to private enterprise, there should be some co-ordinating influence exercised by the Government to see that the utilisation of those water powers was undertaken on some regular and definite plan.

The CHAIRMAN (Sir DUGALD CLERK) said that the census of production taken in 1907 showed that in Great Britain at that time 10½ million H.P. was being used in stationary engines of various kinds for the industries of the country, which amounted to a little over 1 H.P. per worker. In the United States of America, in a census of production taken in 1909, the total horse-power used in a similar way was over 23 million, showing that the Americans had developed the use of power to a very large extent. The Conjoint Board of Scientific Societies had been taking an interest in the water power of the British Empire, and a committee had been formed, of which Mr. Newlands was a member, to study the whole question. The committee was trying to obtain information as to the water power of Canada, New Zealand, Australia, India, and South Africa, and had already made some progress in obtaining data from those countries. There was no doubt that within the British Empire there was a very large amount of water power. The author had estimated the water power of Canada at 17,000,000 H.P. The water power available in New Zealand appeared to be about 7,000,000 or 8,000,000 H.P., and even Australia had a greater water power than this country. It did not seem possible, judging by the author's figures, that in England steam power and other engine power could be replaced by water power to any very great extent, but it was necessary in the interests of the future of Great Britain that coal should be economised as much as possible, and that every available means, including the use of water power, should be adopted in order to lengthen the industrial life of Great Britain.

In reply, Mr. NEWLANDS said that Mr. Morrison was mistaken in thinking that he advocated nationalisation of water power or anything else; he simply wanted it under proper control. Without some Government assistance the development of water power could not make much progress.

In the course of a letter to the *Journal* of the Society on this subject, Mr. ALPH. STEIGER says:—

"I was told in the discussion of my paper on water power, read before the Institution of Electrical Engineers in 1896, that there was no water power in this country worth considering, especially on account of the irregularity of the water supply. I have been able to show, and prove by numerous turbine installations with low and varying falls and a varying water supply, for which I am responsible, that a constant and good water power can be obtained under such conditions. I was told that a water power which is varying, would have to be supplemented during part of the year by artificial power, generated by steam, oil, or gas, at an increased capital outlay which would render such a mixed plant unremunerative. It seems to be entirely forgotten that the initial outlay for such auxiliary power forms a relatively small part of the total capital outlay, while the low annual expenses of the hydraulic plant are only slightly increased by the temporary use of auxiliary power required to

keep up the supply to the demand for power. An absolutely constant power can hardly be found anywhere, and wherever it has been utilised to its full capacity it has been found necessary to add steam plant to comply with the increasing demand, and always to the advantage of the undertaking. I am informed that even at the Niagara power plant steam power is being added.

"In the development of water power the cost is, of course, the first point to be considered. It is generally held that high-fall plants are cheaper than medium or low-fall plants. This is correct only as far as the cost of the turbines is concerned, but long pipe-lines often make high-fall plants even more expensive than medium-fall plants of the same capacity.

"With regard to the economical point of view, the noteworthy fact may be mentioned that in Westphalia, the centre of the German coal industry, whole valleys have been closed by large dams forming artificial lakes for the threefold purpose of regulating the flow of water for navigation of rivers, to prevent flooding, and to obtain power."

ELECTRIC PLOUGHING.

DUE to the havoc of war and the claims of industry, the supply of agricultural labour will be quite inadequate to meet the needs of a vigorous agricultural programme, unless mechanical power be used wherever possible to perform duties which were formerly accomplished by manual labour. Suitable equipment must be provided for the purpose, and the interest and the confidence of the farmer must be secured. Also, if electrically-driven machinery is to be used, overland distribution schemes must be inaugurated, or town distributions extended so as to place "ready-made" electrical energy at the disposal of individual farmers. Isolated power plant, consisting of a steam or oil engine (with or without the addition of a dynamo to supply lighting and small power demands), or of a wind or water-driven dynamo, is already used to a considerable extent, and is undoubtedly a valuable aid to the farmer. On the other hand, the arguments in favour of electric driving in workshop and factory, taking energy from the mains of a supply company, apply with even greater force to the needs and circumstances of farmers and machine farming. We have discussed frequently during recent years the general problem of electricity supply for agriculture, and the use of motors for such purposes as preparing fodder, threshing, pumping, and so forth. In the present notes we propose to deal exclusively with the subject of electric ploughing,* this including a number of problems which must be solved if "electricity in agriculture" is to realise its full possibilities.

Ploughing is one of the primary duties of every arable farmer; it is, moreover, a duty which can only be performed during a few months of the year. Relatively heavy machinery and relatively high power are required for its performance. These characteristics are inherently unfavourable—expensive machinery is necessary, which can be used only for a small part of the year. So far as concerns electrical operation, the power demand is relatively high, but the annual load factor is low, and the demand comes at seasons when the station load from other sources is a maximum. Nevertheless, if suitable equipment be used, electric ploughing can be made technically and commercially successful, but it must be emphasised that the difference between one type of equipment and another is sufficient to alter the whole aspect of the problem.

During the last 18 months or so, steam and oil tractors have been used on a very large scale to break up grass land in this country, but, whilst these machines are undoubtedly well suited to emergency application in any part of the country, they do not offer the best means of ploughing our land year after year under normal conditions. For this service a light, electrically-driven haulage equipment offers many advantages. German trials of electric ploughing have been none too successful, owing largely to the use of too heavy and costly equipment.

Power Requirements.—The end to be accomplished is the exertion of a sufficient pull on the plough. Other things being equal, the necessary pull varies with the breadth and depth of ploughing, and may be referred to the basis of so many lb. pull per sq. ft. of section ploughed. Ringelmann's dynamometer tests yield the following values for the specific effort (k) required:—

Light soil	740 to 820 lb. per sq. ft.
Heavy soil	1,125 to 1,230 lb. per sq. ft.
Four-year lucerne	1,780 lb. per sq. ft.
Heath land	1,260 lb. per sq. ft.

If the furrow be l ft. wide and p ft. deep, the horse-power P required to advance the plough v ft. per second is:—

$$P = klpv/550 \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

This fundamental formula shows that a given area may be ploughed in a specified time by a tool which ploughs a wide furrow at low speed, or by one which ploughs a narrow furrow at proportionately higher speed. The former alternative involves the use of heavy, cumbersome, and costly machines which are difficult to move from place to place, whilst the second alternative is subject to the limitation that the plough cannot easily be steered at speeds exceeding 3 M.P.H., or 4 M.P.H. as a maximum (*i.e.*, 4.4 to 6.6 ft. per sec.).

Suppose that it be required to plough 12 in. deep with a multiple-share plough, ploughing a width of 3 ft. If the soil be heavy and the speed 3 M.P.H., the power theoretically necessary is: $P = 1{,}230 \times 3 \times 1 \times 4.4/550 = 30$ H.P. (approx.). In order to allow for roots, large stones, and losses between motor and plough, it would be wise to provide a 60-H.P. motor in this case. Such a plough would deal (theoretically) with $3 \times 4.4 \times 3{,}600/43{,}560 = 1.09$ acres per hour, or 13 acres per 12-hour day. Actually, one cannot count on more than 65 per cent. utilisation for the day, so that the performance should be about 8½ acres per 12-hour day.

Electric haulages of 75, 90, or even 100 H.P. are sometimes used for ploughing; from 12 to 15 acres per day may then be ploughed, but the equipment becomes costly and heavy.

Systems of Traction.—Whatever the motive force utilised, the plough may be hauled by tractor or winding drum. The great objection to tractors and automobile ploughs in general is the high percentage of the power supplied which goes simply to propel the tractor over what is about the worst possible surface from this point of view. This source of loss

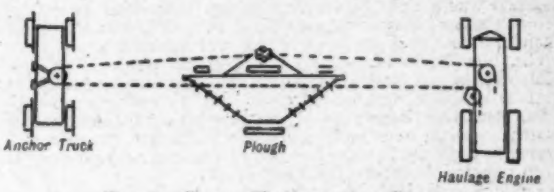

FIG. 1.—SINGLE HAULAGE-DRUM SYSTEM.

is serious enough when breaking up firm grass land, and it may amount to 60 per cent. of the energy supplied in the case of arable land in good cultivation. The net useful tractive effort is limited by the difficulty of obtaining sufficient adherence with the loose soil, which is more damaged (from the farmer's point of view) the heavier the tractor or automobile.

Thanks largely to improvements due to Fowler, rope haulage gear is very popular for deep ploughing. Either one or two rope-haulage gears may be used, the general arrangement in the two cases being as shown in figs. 1 and 2 respectively. In the single-gear system, a cable from the haulage drum is fixed to the plough, and returns *vid* a pulley on an anchor truck at the other side of the field. The haulage gear

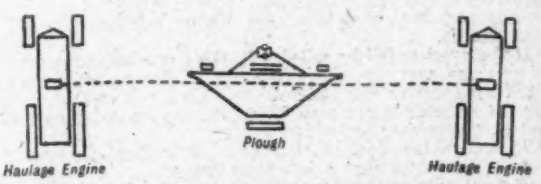

FIG. 2.—DOUBLE HAULAGE-DRUM SYSTEM.

is of the double-drum type, either drum being connected to the motor whilst the other runs free on the shaft. The driven drum pulls on the cable which unwinds automatically from the free drum. At the end of each furrow the double plough is tilted, and the coupling of the haulage drums is reversed; the tractive pull, which was formerly direct is now taken round the anchor pulley. The double-gear method (fig. 2) employs two haulage gears, which pull alternately on a single cable attached to a double-ended plough.

Comparing these two systems, the single system offers the great advantage of very much lower capital cost. The anchor truck is very cheap, so that the cost of ploughing tackle is little more than half that of a pair of haulage-gear trucks; also, only one truck has to be supplied with electrical energy, so that there is a saving in the distribution conductors. On the other hand, there is a double length of rope to be provided and kept in repair, the tackle takes longer to adjust than in the case of the double gear, the anchoring for the return pulley may occasion difficulty, and the system is only applicable to flat ground, over which the driver can see the signals of the man at the plough. The double haulage gear system costs more in the first place, but it may be adjusted more quickly than the single haulage gear; also, it is applicable to furrows up to 650 yd. in length, and may be used over uneven ground.

Tractors.—In spite of the fact that they consolidate the ground, and fail to secure the adherence necessary for very high tractive effort, and in spite of the inefficiency of their propulsion, tractors have been used very successfully in ordinary ploughing (6 or 7 in. deep), harrowing, &c. The only electrical equipment of this type which need be described is

* Basing our remarks on data given by M. Delamarre in the *Revue Générale de l'Electricité*, Vol. I. Nos. 18 and 22.

the Zimmermann electrically-propelled plough, the general arrangement of which is illustrated in fig. 3. Electrical energy is taken from a H.T. line through a step-down transformer car and a heavily insulated trailing cable L (supported on carriages V, V_1, &c., at 50-yd. intervals, and is thus brought to a motor on the plough itself. A chain AB is stretched across the field, and the plough C hauls itself to and fro by means of a toothed wheel engaging with this

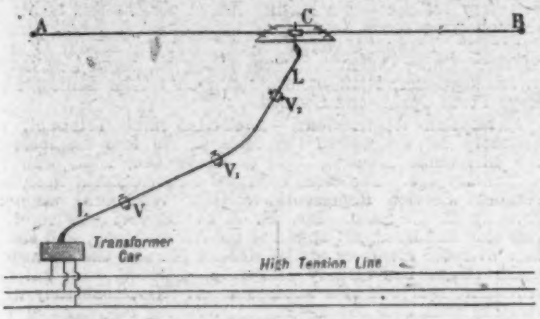

Fig 3.—Zimmermann Self-propelling Plough.

chain. At each end of the furrow the plough is tilted, and a change-over switch reverses the motor. The chain AB weighs from 1 to 1½ lb. per yard, and needs only a light anchor (say, 75 to 90 lb.) at each end.

The "industrial efficiency" of the Zimmermann plough exceeds 50 per cent., and a motor of 15 or 20 H.P. is sufficient. The complete equipment—including 275 yd. of chain, two anchors, 650 yd. of trailing cable, and six carrier trucks for the latter—costs from £355 to £600, according to the H.P. of the motor; Fowler steam haulage equipment costs from five to ten times as much. The cost of ploughing 14 in. deep is about 8s. an acre, if energy costs 1.8d. per KW.-hour. Seeing that this equipment is light, inexpensive, and gives the ploughman complete control over his tool, so that work may proceed at dusk or in fog, it is possible that the system may be received more favourably than it was when first introduced. An improved form of the equipment was introduced in France by M. Maguin, who replaced the flexible trailing cable by a special type of catenary line, from which the plough took current through contact brushes.

Haulage Gears.—At first sight, it seems a very simple matter to mount a haulage drum on a suitable carriage, and then drive it through belting or gears from an electric motor. There were, however, many unsuccessful attempts to build a convenient combination, but now electric haulage gears have been brought to such a degree of perfection (by Eckert, Siemens, A.E.G., Soc. Electrotechnique de Turin, Morelli, Jeumont, and Fillet) that one may say that it is lack of enterprise and sympathy on the part of manufacturers, central-station authorities, and farmers—rather than lack of suitable equipment—which is responsible for the restricted practical application of electric ploughing.

The three types of equipment which may be described as representing modern practice are the Siemens haulage, the Fillet equipment, and a set produced by the Soc. de Constructions du Nord et de l'Est (Jeumont) a few months before the war.

The Siemens Equipment.—This was the first electric haulage set to give real satisfaction in ploughing, and it is used principally in Germany and Spain. One model works in

Fig. 4.—Siemens Plough and Haulage Car.

conjunction with an anchor truck at the other side of the field, whilst a second model is designed for use in pairs. The former equipment has two drums for the tractor cable, these drums being driven alternately by the same motor. The chassis is of heavy construction (fig. 4), and carries an enclosed motor of 60-90 H.P., together with starting gear, cable drums, and a change-over coupling.

In either type, the haulage drum or drums accommodate 440 to 550 yd. of steel rope, and two haulage speeds are provided, viz., 3¼ and 5¼ ft. per sec. (2½ and 3½ M.P.H.). The cable pull is exerted at right angles to the longitudinal axis of the carriage. The motor may be geared either to the cable drums, or to the rear wheels; the carriage is thus self-propelling, and may be turned on a very small radius. An enclosed belt-drive between motor and haulage drum provides for the possibility of the plough encountering roots or large stones; also, it permits the motor to be used conveni-

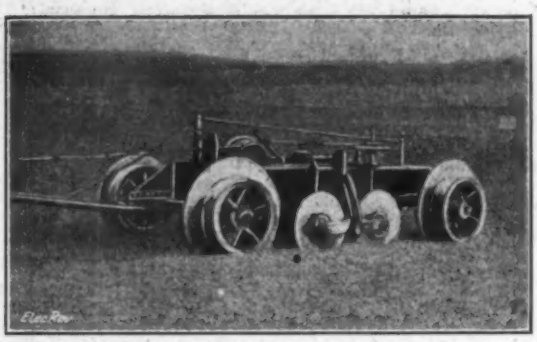

Fig. 5.—Siemens Anchor Truck.

ently to drive threshing machines, line shafts, and so forth. A tramway-type controller is provided, as well as an oil-immersed maximum and minimum cut-out. A tractive effort of 8,800 lb. can be exerted on the haulage cable.

The anchor carriage used with a single haulage truck weighs about 4 tons, and is fitted with disk wheels (fig. 5) in order to secure a sufficient hold on the ground. It is arranged that this carriage is advanced automatically as work proceeds.

The only objection to the Siemens equipment, and unfortunately it is a serious one, is its great weight (about 13 tons), which makes movement difficult, especially over country roads and headlands.

(To be concluded.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Examinations in "Electrical Installation Work."

Referring to your paragraph on the City and Guilds of London Institute on p. 112 of your current issue, we were specially interested in your remarks relative to the examinations in "Electrical Installation Work."

We read that "The examinations were held for the first time on the revised syllabus," and one might gather from this that things were progressing satisfactorily. But what are the facts?

According to a red-ink slip inserted in the front of the City Guilds' programme for this session, no examinations in electrical installation work are to be held this year "in the event of the continuance of the war." This decision requires to be received with disapproval, and the shortsightedness and *laissez faire* policy of the authorities condemned. In times like the present an extra special effort should have been made to provide the necessary recruits to fill the gaps amongst electrical workmen.

There must be "something rotten in the state of Denmark," either as regards the teaching or equipment of the classes, if with 704 students "in attendance" only 121 candidates present themselves (at 38 centres), and only result in 67 passes. This is an average of 1.75 per centre, and, of course, less than that per class. This is a state of things that the profession and the trade should be ashamed of. A fact that should make them still more ashamed is that the examinations in gas fitting are to continue as usual.

In one sense we are glad that the examiner finds that the practical work shows a lack of adequate equipment, as for several years past we appear to have been more or less alone in thinking this.

Money is spent lavishly on the electrical engineering classes, often on unnecessary and expensive apparatus, while the installation work classes are usually starved, and a pair of pliers has often to serve for a number of students. The other "apparatus" is generally on the same meagre scale. This sort of treatment does not make for enthusiasm amongst the students, and those that "stick it" in such circumstances are to be commended for their staying powers.

With a view to drawing more attention to the whole matter, we have inserted the following question in our cur-

rent preliminary examination paper in "Electric Light Switching":—

11. If you have never attended classes in the City Guilds' subject, "Electrical Installation Work," or "Electric Wiremen's Work," was it

(*a*) Because you had never heard of them?
(*b*) Or because they were too far off?
(*c*) Or because you thought you had nothing to learn?
(*d*) Or because you thought the subject was too difficult?
(*e*) Or because the class was inadequately equipped?
(*f*) Or what?

If you have attended such a class, say something about it.

We have also just had this question reprinted on separate slips, and shall send it round in various directions. When we have received a good number of answers we propose to analyse and publish the results. Judging from the answers already in hand, the future analysis promises to provide some remarkable revelations.

If any of your readers care to send in answers of their own, with name and address attached as evidence of genuineness (not for publication), we shall be very pleased to receive them.

A. P. Lundberg & Sons.

477-489, Liverpool Road, Islington, N. 7.

[We agree that the decision to suspend the examinations in "Electrical Installation Work" is very regrettable, in view of the present and prospective demand for wiremen. As regards the small number of passes, it should be remembered that many students have been compelled to cease attendance owing to their being called up, and others by the pressure of work thrown upon them.—Eds. Elec. Rev.]

German Influence in the Swiss Electrical Industry.

Referring to the article printed in the issue of your valued paper on February 1st, 1918, pp. 99-100, and especially to the statement in the last paragraph: "Apart from the fact that the author has refrained from mentioning any other Swiss manufacturing companies, it is rather unfortunate, &c.," the writer thinks that this statement might be misinterpreted, and possibly throw some doubt upon works not mentioned in the article.

This, naturally, was not the intention of Mr. E. Tissot, who rather considered it as an axiom that all the world knew that the Oerlikon Co., for instance, required no defence.

It has been the policy of the writer, ever since the outbreak of the war, never to wait until doubt was thrown on the status of his company, but, on the contrary, to invite the widest possible publicity as regards the Oerlikon Co.'s affairs.

He has given all interested Government Departments and his company's *clientèle* the governing factors, and we are so free as to send you herewith a photo of the last statement issued by the Oerlikon Co. in relation to its share composition. It is dated April 12th, 1917, and is similar to previous statements issued on identical occasions. The position therein described is on a par with that existent also previous to the war.

British, Irish & Colonial Dept.,
Ateliers de Construction Oerlikon.

G. Wuthrich, *Manager and Chief Engineer.*

London, W.C., *February 1st*, 1918.

V.B. Cable Breakdowns in the Tropics.

In reply to Mr. D. M. W. Hutchison's letter in your issue of 25th inst., referring to my article in your issue of September 7th, 1917, cables made in the manner referred to have been commercially made and supplied (under the trade name of "Cloida") for the past four years approximately—the date of the patent was April, 1914.

With regard to Mr. Hutchison's question as to results, no instances have been discovered in such cables in the interim of the peculiar deterioration which the method of construction was designed to avoid.

It is only fair to state, however, that this evidence is somewhat negative in character, because—except under extremely severe and usually preventable local conditions, leading to the early establishment of the leakage factor—the kind of deterioration in question takes fully this period to develop.

I have sent Mr. Hutchison a copy of my paper on "Cables" (I.E.E. *Journal*, Vol. LIII, 1914), in which the investigations to which he refers are published in a condensed form, in order that he may have evidence of a more positive character on the subject.

C. Beaver.

Manchester, *January 29th*, 1918.

Rosin Oil.—The Minister of Munitions has called for returns from all persons dealing with rosin or rosin oil, and prohibited dealings except under licence, unless the quantities dealt with are small. Applications for licences are to be addressed to the Controller, Non-Ferrous Metals Supply, M.S.-L., Ministry of Munitions, 8, Northumberland Avenue, W.C. 2.

WAR ITEMS.

Canadian Lighting Economies.—By prohibiting the use of energy for advertising, discontinuing cluster lighting, and reducing street lighting the Ontario Hydro-Electric Commission will save 50,000 H.P.—*Times.*

Trading with the Enemy.—The "London Gazette" for February 1st contains a further list of persons and bodies in the following countries trading with whom is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Colombia, Cuba, Denmark, Hayti and Dominican Republics, Netherlands, Netherland East Indies, Norway, Peru, Spain, and Sweden.

Exemption Applications.—The Ilfracombe Tribunal, on February 1st, considered the cases of the four members of the Ilfracombe Electric Light & Power Co., Ltd., who are of military age. The cases occupied a considerable time, the National Service Representative (Mr. Woodcock) strongly pressing in all cases. Mr. H. J. F. Stewart (the resident engineer and manager) appeared for the company, and stated that over 500 members of the staff of his and the connected undertakings had already joined the Colours, and that the remaining staff was at a minimum. At Ilfracombe they were running with half the number of workmen employed at the declaration of war, and could not spare another man, there being now (excluding stokers) only two skilled men left, one engaged on generation and the other on distribution. The company had used every means to obtain substitutes for these without success. Mr. Woodcock said if Mr. Stewart could get certificates for his men under the Protected Occupations List he would not further oppose. Mr. Stewart pointed out that while giving a certain supply for war work, it was hardly sufficient to justify this course, but that the list of certified occupations covered the men, and on that he asked the Tribunal to give exemptions, unless the National Service Representative could clearly show them that it was in the national interests that the men be taken for the Army, or for other work. The Tribunal adjourned two cases for substitutes and two for re-examination. An interesting point arose over a relief stoker, cleaner, engineman, &c., who Mr. Woodcock claimed could not be classified as a skilled man, though he afterwards admitted he was "semi-skilled." Mr. Stewart claimed that any man that could stoke high-pressure boilers fitted with superheaters and modern grates, mechanical and forced draught, was "skilled," though, admittedly, not so highly skilled as the charge and distribution engineers. Mr. Stewart said it would take "an intelligent labourer" more than a year to learn to carry out the duties of the man in question, and he must ask the Tribunal to exempt the man, the list of certified occupations excepting only "unskilled men," and it did not there state that "only skilled men" were entitled to exemption.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has granted exemption until April 30th to J. Kershaw (37, Class A), overhead linesman, appealed for by the Corporation tramway department.

Hastings Tribunal has granted three months' exemption, subject to his rendering some public service, to J. Kennard (27), motorman on the electric tramways.

After considering appeals by the Potteries Electric Traction Co., Ltd., the Stoke-on-Trent Tribunal has decided that five employés should be released subject to substitutes being found.

The Rochford (Essex) Tribunal has refused exemption to his son (18), appealed for by Mr. J. F. Woodford, electrician, Hadleigh.

At Salisbury, an appeal was made by an electrician's assistant (18, passed for general service). He is engaged at the Porton experimental station at a wage of 25*s.* per week, and the Chairman said that apparently an electrician's assistant was not so important as a carpenter's labourer doing odd jobs at the same works, and who was paid 30*s.* per week. It was decided that the Military Representative should try and get the youth's father released from the Army, so that the son could serve in his stead.

At Oldham, the Corporation tramways department appealed for a motorman (33, Grade 2), and he was given exemption until April 30th.

On the appeal of Messrs. T. B. & W. Cockayne, Ltd., exemption until the end of February has been granted to W. Fuller (37, Class A), electrical engineer.

At Oxford, Messrs. Wyatt & Son, of St. Giles's, appealed for the retention of E. P. Green (36), electrician, and two months' temporary exemption was granted.

An electrician (35), appealed for by his employer at Eartham (Sussex), was granted three months' exemption by the East Sussex Appeal Court.

The National Service Representative appealed to the West Kent Appeal Court against three months' exemption granted to H. G. Tomlin (33) and E. Upton (39), both passed for general service, coal unloaders at the Maidstone Borough electricity works. The electrical engineer (Mr. E. E. Hoadley) said that the men were not in the permanent employ of the Corporation, except that they had to unload coal when required. They worked in a gang, and on an average were engaged four days a week. A mechanical apparatus when installed would dispense with the need for so many men, but two months would probably elapse before it was in

thorough working order. The appeals were allowed, the men not to report for service for 42 days.

High Wycombe Tribunal has granted six months' temporary exemption to S. F. Root (41, Grade 3), electrician, appealed for by the Marsh Paper Mill Co.

At Leyton, the Urban Council appealed for the retention of four employés in the tramway department. Lieutenant Grevis Pain, for the Military, said that he should not press for drivers, but he must for inspectors. Mr. F. Schofield: But they are motormen first, and then made inspectors. I am working the drivers seven days a week. Two of the men were exempted until substituted; the other two each received six months.

Before the Herts Appeal Court, exemption was claimed by E. F. Chalkley, electrical engineer, of St. Albans. He had been placed in Class A, but appellant handed in a medical certificate expressing the opinion that he should be graded only C 3. Medical re-examination ordered.

An electrician who appealed at Burnley was stated to have been discharged from the Army, but had not been overseas. He was exempted until the end of April.

At Reigate, with the assent of the Military, three months' exemption has been granted to W. P. MacAlpine (38), electrician, magneto repairer, and mechanic, appealed for by the East Surrey Traction Co., Ltd.

At Colchester, five tramway employés, four passed for general service and one in Class C 1, were appealed for. The National Service Representative said that he and the Advisory Committee considered that three of the Class A men were absolutely necessary to the undertaking, and he would assent to their exemption. The other two were given final exemption until the end of March.

At Burnley, an appeal was made for an electrical engineer (30, B 1), 4 ft. 11 in. in height and 89 lb. in weight. He had been rejected on three occasions. The Mayor: The last time he went they just swore at him! The employer said the firm had to keep eight munition works going, and each of these controlled firms could reserve an electrician of their own. Exemption to the end of February, and to be re-examined.

BUSINESS NOTES.

Anglo-Italian Trade Relations.—In the course of an address given to members of the London Chamber of Commerce, at their headquarters in Cannon Street, on February 1st, with reference to our trade relations with Italy after the war, Viscount Hythe said the enormous control which Germany had acquired in Italian industries in the 10 years preceding the war was well known, and this influence enabled them to secure a market in Italy for many of their products, notably machinery. The main lessons from the experience of this war were that every country ought to aim at establishing within its borders all essential industries, of which the most important were agriculture and the manufacture of munitions. Every country would further endeavour to manufacture articles of which she possessed the raw materials. Italy's supply of iron did not meet the national requirements, and she was almost wholly dependent on imported coal. Electric energy might take the place of coal as motive power, but in many branches of manufacture coal and coke were essential. The production of machinery in Italy was limited by the fact that she did not possess iron ore sufficient to supply the needs of her home markets. During the last 30 or 40 years she had built up by means of a tariff an iron and steel industry which more than absorbed the production of iron ore from Elba and the other mines in the country. France and Spain were possible sources of supply for iron ore. Before the war, France exported to Germany 2,000,000 tons per annum. Italians considered that they should be able to secure a proportion of the ore which previously went to Germany, and that a further supply was obtainable from Spain. For steel the United States was the greatest source of supply. The consumption of electrical energy had more than doubled in the last nine years. The number of KW.-hours on which taxation was paid had risen from 1,008,759,868 in 1907-8 to 2,613,395,633 in 1915-16. In view of the enormous difficulties with which Italy had had to contend during the war owing to her dependence on British coal, it was certain that there would be a great increase in the use of hydro-electric power in the immediate future. Projects for utilising the available water power from the Alps and Appenines were in progress, while important organisations had been formed for utilising hydro-electric power plants in Calabria, Sicily, and Sardinia. Owing to German penetration, and to the fact that German banks and German manufacturers took a leading part in the development of the hydro-electric power plants established from 1904 onwards, electrical machinery had been hitherto mainly supplied from Germany or by firms in Italy which were controlled by Germans. Great Britain should be able to supply a considerable proportion of the machinery previously supplied by Germany—*e.g.*, motors and dynamos, as well as electrical fittings and lamps (for which there was a great shortage in Italy at the present time), also material for electric trams and electrification of railways. There were four firms in Italy making electric machinery, viz., Tecnomasio Italiano (late Brown-Boveri), Galileo Ferraris (late A.E.G.), Marelli, and Westinghouse, whilst other companies were preparing to make electrical machinery. The power of production of Italian factories being limited by their dependence on imports for a considerable proportion of their supply of raw material, there was a great opening for British manufacturers in the supply of electrical machinery. The Italian firms above mentioned could not supply the Italian demand.

Having outlined the various steps that should be taken by manufacturers and merchants in this country, Lord Hythe said while it was obviously impossible to develop British trade during the war to any considerable extent, owing to shortage of freight and to the lack of raw material and labour with which they had to contend, it was possible to prepare the ground for the development of trade after the war, and it was of the utmost importance that a beginning should be made on a small scale now, even if this meant some slight restriction on the redundant activity of the Munitions Department. Whether we were going to have Imperial preference or not remained to be seen, but it would be far better for the question to be decided one way or the other now, than to wait until the end of the war for a decision.

Co-operative Effort for Export Trade.—In our issue of December 14th, 1917, we described and discussed the new co-operative scheme for the cultivation of export trade which was proposed by Sir Charles Mandleberg, of Manchester. We are pleased to learn from Sir Charles that the proposal to form a British Manufacturers' Corporation for the purpose of carrying the scheme into effect is receiving the support of manufacturers in all parts of the United Kingdom. The details have now been developed in one or two important directions, notably with regard to the selling arrangements and the extension of banking and other facilities to firms who have not yet embarked on export business. Some of the points set forth in the fresh draft which is now before us are as follows:—

Members whose business is of a highly-technical nature may prefer to send out a resident representative of their own to do their selling, in which case it would be an undoubted advantage, and would give them confidence, if their representative could refer to the Agent-in-Charge as to the best methods of developing business in that country and for particulars of firms likely to be useful, and their standing. In an emergency such as might arise through illness or other cause, the Agent-in-Charge would be on the spot to act as he might be instructed.

In the case of firms who send out travellers, the Agent-in-Charge would be in a position to give the latter the latest information and act in any emergency, as already indicated. It is understood that any information as to possible orders given to any resident representative, traveller, or selling agent would be given at the same time to all such in the same line of business.

For manufacturers not yet accustomed to dealing direct with foreign firms, and apprehensive of the risks of such a departure, it will be possible to make arrangements giving them a sense of security and confidence. In addition to having advances by their bankers against bills of lading, where required, they could have their new foreign accounts, where orders are taken from responsible firms, partially guaranteed against loss on this side. Means already exist, of course, for partially guaranteeing foreign accounts in this manner, and these, if desired, could be utilised. This matter has for some time been engaging the attention of the British Trade Corporation, which hopes soon to have a comprehensive scheme to submit.

A scheme embracing these points offers advantages to every manufacturer or exporting house seeking fresh markets. With very few exceptions no firm is directly represented everywhere, and every market left unexplored is a neglected opportunity. With the means at their disposal as members of the organisation, the large houses could, at small expense, try out the market in fresh areas. The activities of the new Corporation now suggested would not encroach on the sphere of any known organisation of manufacturers and exporters. Neither would they be in conflict with the objects of the new Government proposals for helping overseas trade, which are to be heartily welcomed. On the contrary, they would be complementary to the Government's efforts; they would supply the business touch and secure the prompt decision and dispatch indispensable in this world of competition, but which, owing to the circumlocution necessarily attendant upon official routine, cannot, with the best will in the world, be attained by way of those efforts alone.

We regret that pressure upon our space in these exceptional times prevents us from detailing the scheme more exhaustively. We recommend firms who are interested in the matter to place themselves in communication with Sir Chas. Mandleberg, at Albion Works, Pendleton, Manchester. In order to carry the heavy financial burdens of the war we must develop our export trade for all we are worth, and if this organisation is likely to furnish small firms or others with facilities for doing that with efficiency and economy, it will merit their support.

Electrical Supplies for South Africa.—The *South African Mining Journal* of December 22nd states:—"There are several Japanese boats at the coast, and they have brought us fair supplies of electrical accessories, which, added to our present stocks, will suffice, as no ordinary job need stand still, providing contractors pay the enhanced prices. The heavier kinds of wiring have advanced about 20s. per coil, such as 7/22 at 48s., 7/20 at 75s., and 7/18 at 85s. The British supplies are coming through practically by every mail, not overmuch at a time but sufficient to show that endeavours are in evidence to keep in close touch with our most important requirements, in the smaller accessories, as distinct from machinery, which is practically non-existent in the British exports. We cannot obtain much relief from America, as their standards are peculiar to their own country and not co-ordinate with the British standards, which no doubt will be made uniform some day."

Tungsten and Molybdenum Wires.—In response to an application by Messrs. Duram, Ltd., under Schedule 42 (1) of the Finance (No. 2) Act, 1915, to the Commissioners of Inland Revenue for an increase of the statutory percentage for Excess Profits Duty, as respects "the business of manufacturing in a malleable form metallic tungsten and molybdenum direct from the ore or from metallic salts, with or without the manufacture of chromium from chrome ore," an Order has been made increasing the statutory percentage in the case of any trade or business carried on or owned by a company or other body corporate to 12 per cent.

Catalogues and Lists.—The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W. 8.—The January issue of the "E.A.C. Quarterly Review" contains "Roll of Honour Notes," particulars of starting characteristics of squirrel-cage motors, slow-motion starters, induction meters, pillar type control panels, &c.

British Thomson-Houston Co., Ltd., Rugby.—Sixteen-page list (No. 4,161) in their standard style and size, giving a fully illustrated description of their ironclad oil-break switchgear type O, form K.

Hilbar Press, 72, Finsbury Pavement, London, E.C.—Circulars relating to their dry battery supplies.

Messrs. Ercole Marelli & Co., of Milan, have sent us a set of fac-simile testimonials received from clients to whom they have supplied their electric ventilating fans and blowers and aspirators.

Messrs. Cole, Marchent & Morley, Ltd., Prospect Foundry, Wakefield Road, Bradford.—Sixteen-page illustrated brochure containing a full description of the Spencer-Dawson patent power brakes for tramcars, &c.

British Electric Vehicles, Ltd., Hoghton Street, Southport.—Illustrated circular repecting their B.E.V. electric industrial trucks.

Trade Advisers.—The *Board of Trade Journal* announces that the President of the Board of Trade has appointed three gentlemen to be Trade Advisers respecting the textile, leather and building and furnishing trades. They will be attached to the Industries and Manufactures Department of the Board, and will advise the Board as to the conditions and requirements of their particular trades during the period immediately following the war, and as to any action which it is desirable should be taken by the Board in respect thereto.

Book Notices.—"Liquid Fuels for Internal Combustion Engines." By H. Moore. London: Crosby Lockwood & Son. Price 12s. 6s. net.

"The Training of our Industrial Forces." By H. F. L. Orcutt. London: *Engineering*, Ltd. Price 1s. 6d. net.

Bankruptcy Proceedings.—W. T. Smith, electrical and mechanical engineer, Victoria Street, Bolton.—First meeting was held February 6th, at Byrom Street, Manchester; public examination, February 13th, at Bolton.

Liquidations.—British Autogenous Welding Co., Ltd.—This company is winding up voluntarily, with Mr. L. M. Fox as Liquidator. Meeting of creditors at 268, South Lambeth Road, S.W. 8, on February 8th.

Calendar.—Messrs. Stewarts & Lloyds, Ltd., have again favoured us with one of their very acceptable calendars with monthly slips in a white and gold frame.

LIGHTING AND POWER NOTES.

Accrington.—Price Increase.—In order to meet the increased cost of production, including the increased bonuses awarded by the Committee on Production, the Electricity Committee is increasing the existing charges for current for lighting purposes by 10 per cent.

Australia.—Mr. J. Harper, the Melbourne city electrical engineer, has reported on the experiments made with brown coal since August 14th last, that long series of tests had enabled him to improve the process of combustion to such an extent that brown coal offered no difficulties whatever in its use for the production of electricity on a large scale. The present type of furnace required to be altered, owing to the fact that the production of clinker prevented it from being used more than six or seven hours at a time without the necessity of shutting down for cleaning purposes. To obtain continuous use of the furnace, it was necessary to remove the stationary grate and fit a stepped grate, which would provide for the automatic discharging of ashes and clinker, at a cost of £400. In all furnaces about 2,816 tons of brown coal had been burnt; its consumption had resulted in a net saving of over £500 as compared with New South Wales coal. The Electricity Committee recommended the adoption of the report, which has been agreed to by the Council.

The Sydney Municipal Council has received a report from the city electrical engineer as to the result of the industrial crisis which occurred during August, September, and October last year; although the restrictions placed on the supply of electricity were less stringent in the case of this strike than they were in the one in 1916, the strike last year lasted over a much longer period. It is estimated that the loss incurred during the strike period in 1917 amounted to £47,222, £41,377 being loss of revenue alone.

Barrow.—New Plant.—The Electricity Committee reported that the Ministry of Munitions had sanctioned the ordering of an additional turbo-alternator of from 2,000 to 3,000 kw., together with the necessary auxiliary plant; application is to be made to the L.G.B. for sanction to the borrowing of the necessary amount for the extensions, for which, in view of the urgency of the matter, orders had been placed.

The National Amalgamated Union of Labour has made application for an increase of wages on behalf of all general workers in the gas and electricity undertakings; the application has been referred to the Corporation Departmental Committee for consideration.

Bradford.—Wages.—The result of the ballot of 5,000 Corporation employés on the matter of acceptance of the Corporation's offer of an advanced war bonus or arbitration—as mentioned in last week's Electrical Review—was announced last week-end. The result was a majority of one in favour of arbitration, 2,298 having voted thus, 2,297 in favour of acceptance, 513 declined to vote, and there were 1,227 spoiled papers. On considering this position the War Wages Committee decided that the matter should be referred to arbitration by the Committee on Production so far as the certified undertakings—gas, electricity, and tramways—were concerned. Employés in other departments are to be invited to agree to the matter being referred to the same body. The employés, on Sunday, gave notice to the Chief Industrial Commissioner that there is a dispute pending, and appointed Mr. W. Leach as their representative in the arbitration, which they prefer to be local.

Canada.—According to the *Electrical World*, the Ontario Hydro-Electric Commission is to build a third tunnel at the plant purchased from the Ontario Power Co., and it is expected to develop an additional 50,000 h.p. Work is to commence immediately, and the cost is estimated at 1½—2 million dollars.

Continental.—France.—A company has lately been formed in Paris, with a capital of £240,000, and the title La Société Electrique des Houilleres du Pas-de-Calais, with the object of establishing electric generating stations in connection with the collieries in the district mentioned.

Germany.—At a meeting of representatives of all the central stations in Wurttemberg, it was decided to unite under a single management. The various power stations are to be interconnected, and arrangements made for economical generation and distribution of energy. A Committee is working out details for the incorporation of a separate distributing company to handle the entire production. The Hungarian Parliament has also passed a Bill for combining all the central stations in the country into one organisation. A central management is to control the output and production.—*Electrical World.*

Darwen.—The T.C. has granted a war bonus of 7s. per week to skilled employés in the electricity works and of 3s. a week to other workers.

Derby.—Plant Extension.—The T.C. has approved of a scheme for the extension of the Corporation electricity station by the provision of a 6,000-kw. generating plant, in order to afford a further supply of energy to the works of the British Cellulose and Chemical Manufacturing Co. Application is to be made to the L.G.B. for sanction to the borrowing of £87,000, the estimated cost of the extensions.

Dublin.—Cottage Lighting.—The estimate for the electric lighting of over 200 cottages in connection with the McCaffey Estate Housing Scheme of the Corporation is stated at £1,200, the cost per cottage amounting to £5 18s. 10d.

The Lord Mayor recently reported to the Council that on investigation it was found that in the case of the official who it was suggested owed 10 years' electricity accounts, that the official took over responsibility for these, and, prior to his death, they had been paid regularly for a number of years; the account totalled £378, and £304 had been paid. The bad debts since the Pigeon House works were started had amounted to £250 per annum, or '35 per cent. of the income, and the cost of collection was '91 per cent., including accountancy in the rates offices. Attention was drawn to the fact that the Admiralty had arranged with the Dublin United Tramways Co. to supply energy for hay compressing machinery at the Alexandra Dock extension; the opinion was expressed that preferential treatment had been accorded to the company, the Corporation having the sole right of supply in the area. It was agreed that the Lord Mayor should raise the question with the authorities during a forthcoming visit to London.

Extensions.—The Electricity Committee in a special report, is recommending that new generating plant be obtained for the Pigeon House station, to include a 5,000-kw. turbine set, with condensing plant, boilers, &c, at a cost of £60,000; also that a 6-ft. tunnel be built under the Liffey to carry h.t. cables to a new sub-station at North Wall, the cost of the tunnel, mains and sub-station being estimated at £50,000; the Committee also recommends that there should be included in the proposed application to the L.G.B. a sum of £65,000 for distribution work, loans to this amount, however, only to be raised as required.—*Irish Times.*

Dudley.—The T.C. has decided to present a petition against the Bill promoted by the Shropshire, Staffordshire, and Worcestershire Electric Power Co.

Edinburgh.—The Electricity Committee has decided that, in addition to the restrictions imposed by the Ministry of Munitions, it will reserve to itself the right to suspend connections, when necessary, until the plant is extended, and not to make connections where there are gas or other means of lighting or heating.

It is recommended that Dalmeny shall be included in the electric lighting area of the city.

Exeter.—Wages.—The application of the employés of the Corporation electricity department for increased war bonus has been referred to the Committee on Production.

Gainsborough.—Electric Power Station.—Mr. James Marshall has for the present withdrawn his application to the P. of T. for a provisional order for supplying electricity for public and private purposes. Meanwhile, the firm is proceeding with the building and equipment of a large new power station by the Trentside.

Horsham.—Price Increase.—The U.D.C. has decided to increase the price of current as from the March quarterly meter readings.

Kingston-on-Thames.—Plant Extension.—The T.C. has approved of an agreement with the Ministry of Munitions for a loan of £25,000 for a period of 20 years at 6 per cent., and the sanction of the L.G.B. has also been obtained. The loan is for the installation of additional electrical plant and equipment for increased power production for the supply to local firms. The plant will consist of two water-tube boilers, buildings and accessories, two 1,000-kw. steam turbo-alternators with the necessary engine house plant, switchgear, distribution plant, and sub-station transforming gear.—*Surbiton Times.*

Lancaster.—Wages.—The local secretary of the Electrical Trades Union has asked the E.L. Committee for an increase of wages of 12½ per cent. The matter is under consideration.

Liverpool.—Year's Working.—The surplus on the working of the Corporation electricity department for 1917 is £100,298, of which £35,298 is to go to the renewals account and £65,000—as last year—to the general rate. It is recommended that in consequence of the various war additions to the cost of production, including the increased bonuses, that the charges for electrical energy be increased as from the end of the present quarter by the addition of 17½ per cent. to the total of all charges now in force, except that for current supplied to the tramways.

The Finance Committee is recommending an increased rate of 1s. 6d. in the £; the additional demands, it is stated, are mainly due to the increased wages and bonuses to Corporation employés, and the rate is supplementary to the usual assistance from the trading departments, including £125,000 from the tramways and £65,000 from the electricity undertaking.

London.—Southwark.—In view of the recent increase in wages and retrospective expenditure in connection therewith, the Electricity Committee has decided to increase the charges to power, lighting, and heating consumers by 10 per cent., and to charge an additional 33⅓ per cent. to consumers holding contracts not affected by the previous revision of prices, to take effect as and from March 31st, 1918; the limit of 20s. in the coal clause is also to be varied from 20s. to 15s. per ton.

Islington.—The Lighting Committee reports that, as officially tested, the cooling towers recently erected do not comply in all respects with the guarantees given by the makers. After negotiations, the contractors have agreed to reduce the contract price by £100, which the Committee has accepted.

L.C.C.—The Finance Committee recommends the Council's sanction to the application of the Shoreditch B.C. for an additional sum of £16,180, the extra cost of the plant required in the modified scheme of extensions, and to agree to the application that repayment of the whole loan (£17,990) may be postponed for a period of two years.

In consequence of the imposition of the 12½ per cent. bonus, in addition to the ordinary war bonus, the City of London Electric Lighting Co., Ltd., gives notice of an increase in the war percentages on electricity supply during the current quarter to 33⅓ per cent. for power, and 25 per cent. for lighting and heating.

Lydney.—The R.D.C. has decided to enter notice of opposition to the Gloucestershire Electric Power Bill. Opposition is also being offered by Gloucestershire C.C. and the Stroud U.D.C.

Salford.—It has been agreed to supply premises now being erected in Pendleton with high-tension three-phase current at 6,600 volts, and a minimum payment to the Council of £600 per annum for five years is guaranteed.

South Africa.—The Cape Town City Council has decided that, having regard to the additional cost of production consequent upon the war, an increase of 10 per cent. be made in all charges for electric current supplied, including minimum charges, except in cases where the supplies of energy are provided under special agreement; also that the charges for the hire of motors, cookers, heating irons, &c., be also subject to an additional charge of 10 per cent., such increase to take effect from January 1st, 1918.

Owing to shortage of steam power, the Council has for some time past prohibited the extension of light and power installations. The new boiler having now arrived, extensions of lighting and for water pumping only are to be allowed. The Council has agreed to supply energy free for the lighting of the new Troops Rest House and also for the Rest House for Coloured Troops.

At a recent fire at the premises of Messrs. Brimble & Briggs a fireman received a shock from a live wire, which threw him on to the roof and rendered him unconscious for a time.

The Council has approved of a recommendation from the acting city electrical engineer that an all-round bonus of approximately 10 per cent. on the annual salaries of the staff be paid, except the shift engineers, whose case would be met by 5 per cent.

St. Annes.—The output of the electricity works for the year to the end of December was 1,398,130 units, as compared with 968,808 in the preceding year. The greatest increase was in current for industrial power, which rose 197,246 in 1916 to 516,002 last year. There are now 1,924 consumers. In spite of the curtailed supply the December output showed an increase on the previous year.

Stoke-on-Trent.—Linking-up.—The Electricity Committee has confirmed an agreement made between representatives of the Stoke and Newcastle-under-Lyme Electricity Committee with regard to the linking-up of the services, and has decided to apply for sanction to borrow £2,370, the estimated cost of the extension of the mains.

Tasmania.—Hydro-Electric Report.—The third annual report of Mr. J. H. Butters, chief engineer and general manager of the State Hydro-Electric Department for the year 1916-17, contains a lengthy account of the activities, present and prospective, of that department. At the end of 1916 Parliament authorised the expenditure of a further sum of £171,000 for extensions, including a 5-ft. diameter wood stave pipe line, a welded steel pipe line to carry 16,000 h.p. of water, an 8,000-h.p. turbo-alternator set, 7,000 k.v.a. of h.t. transformers, a 4,000-k.v.a. outdoor sub-station for the Electrolytic Zinc Co., at New Town, and a transmission from there to North-West Bay, where another 4,000 k.v.a. sub-station is to be provided for the Hydro-Electric Power and Metallurgical Co.'s carbide works. Contracts were placed for the carrying out of the work, but considerable delay has occurred in securing equipment. Mr. Butters considers it extremely desirable that a complete water-power survey of the State should be made with a view to future developments.

Estimates have already been made of the water power in (1) the upper reaches of the River Onse, (2) Arthur's Lakes, (3) Lake St. Clair, (4) the River Dee, (5) the Franklin River, and (6) the King River. The latter offers an excellent scheme for developing 40,000 h.p., and in view of the fact that the Mount Lyell Co. would take 25,000 to 30,000 h.p. for the working of the Mount Read and Rosebery zinc deposits which are in the vicinity, and that other companies are prepared to take a share, it is recommended that an early start should be made with the preliminary work.

At the present time hydro-electric activity is confined to the South, and it appears certain that the next development will be on the West Coast; so far it has not been commercially possible to connect Launceston and the North to the system, an expenditure of £80,000 being necessary on transmission lines. The gaugings at the Great Lake show that 58,000 turbine h.p. has passed the dam continuously during the year, while other subsidiary sources of water bring the total to 65,000 h.p.

Tetbury.—The U.D.C. has decided to oppose the Gloucestershire Electric Power Bill.

Todmorden.—The Corporation, last week, decided to grant an additional war bonus of 3s. 6d. per week to practically all the municipal departmental employés.

Torquay.—The Electricity Committee has decided that no more new connections necessitating the hiring of a new meter shall be made until after the close of the war, owing to the requirements of the Ministry of Munitions. Consumers are asked to use precautions against the overloading of existing meters in order to avoid damages.

United States.—A Bill providing for the improvement of river navigation by private capital, and for the utilisation of the resulting water power, has been passed by the United States Senate. The Bill provides for the improvement of the navigation of rivers without cost to the Government in connection with hydro-electric dams in navigable rivers; for grants by the Secretary of War of authority for the construction, &c., of such dams; for payment to the Government for benefits resulting from improvements to headwaters; for the regulation of rates and service; for reserving State authority over the waters and water powers; and for leasing surplus water generated at dams constructed by the Government.

Wallasey.—Increased charges for electricity are to come into operation at the end of the present quarter. The increases are:—Private lighting, from 3¾d. to 4¼d. per unit; power, from 2¼d. to 2¾d.; heating, from 1¼d. to 2d.; and traction, from 1·4d. to 1·68d.

West Bromwich.—The Electricity Committee reports that the plant has been installed at the sub-station at Spon Lane. The Council is to lodge a petition against the Shropshire Electric Power Bill, so that the interests of the municipality may be protected. Application is to be made to the L.G.B. to sanction borrowing powers for £1,517 overspent on mains extensions.

Yorkshire Electric Power Co.'s Bill.—The Thurstonland U.D.C. has decided to support the above Bill, and Linthwaite U.D.C. to oppose it; Rotherham R.D.C. is to petition against the company's Bill, and also that of the Rotherham Corporation. Wakefield City Council and the Kirkburton and Lepton U.D. Councils are holding special meetings to consider the Bill, while the Altofts, Guiseley, Slaithwaite and Thurlstone U.D.C.'s have decided to take no action in the matter. Slaithwaite is protected by a prov. order of its own, and Guiseley has already approved of an application for a prov. order by the Electrical Distribution of Yorkshire.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Tramway Purchase.—The T.C. is applying to the B. of T. for an Order extending for one year the period during which the Council is entitled to purchase that part of the undertaking of the Oldham, Ashton, and Hyde Electric Tramways Co., Ltd., which is within the borough. The Corporation, it is stated, has been unable to come to terms with the company

for the purchase, and the B. of T. Order is necessary for its protection. The company's lease of 21 years has now expired. Councillor Judson, in reply to a question, was informed that the object of the request was to enable the Corporation to continue the negotiations, and these would be resumed at once. The resolution would not prevent the purchase of the tramways this year, if terms could be arranged, but if the resolution had not been passed the company could go on another seven years.

Belfast.—Traffic Returns.—According to the official returns, the financial state of the Corporation's tramway system is steadily improving, and, indeed, may be said to have turned the corner, the new fares and revised stages being largely responsible for it. The receipts for the month of December came to £32,281, as against £30,036 and £30,683 in the preceding months of November and October. In December the surplus profits ran to £3,242, and if that surplus profit be maintained it will put the tramway finance into a comparatively comfortable position. For the nine months of 1917 ending the 31st ult. the surplus profits were £7,048, as compared with £5,123 in the correspoding period of 1916.

Blackburn.—The threatened tramway strike has been averted. The Tramways Committee has offered to meet the representatives of the tramway employés on the points at issue, and an early meeting is being arranged.

Bradford.—Accident.—A serious tramway accident recently occurred on the Allerton route, when a car cautiously descending a hill left the track at a curve, and ultimately overturned. The driver was dead when removed from under the car, and 13 passengers were more or less injured. The accident is supposed to have been due to the greasy rails.

Colne.—The T.C. on January 31st adopted recommendations as to improvements and renewals and the relaying of certain crossings and lengths of the Corporation tramway track, which are considered necessary in order to bring the system up to an efficient working condition. It was decided to take steps for obtaining the consent of the Board of Control to the carrying out of the work, which is estimated to cost £3,320.

Continental.—Spain.—The Maracena-Atarfe section of the new electric tramway between Granada and Atarfe has just been completed and opened for traffic. The rails were supplied by the Sociedad Altos Hornos de Vizcaya, of Bilbao, while the necessary electric cables were obtained from the United States.

Lancaster.—During the last six weeks the Corporation tramways carried 234,510 passengers, the receipts being £837, against 224,171 passengers, and £730 receipts a year ago. The tramways are now paying.

Leeds.—It is announced that of the men from the Corporation tramways department who are serving in the Army and Navy, 13 have won distinction. One has gained the D.S.O., four the D.C.M., and eight the Military Medal.

Liverpool.—The Corporation tramways department shows a surplus for 1917 of £167,243, of which the Committee proposes to tranfer £42,243 to the reserve, renewals, and depreciation account, and £125,000 to the general rate. The allocation is at the same rate as in the previous year.

London.—L.C.C.—The Highways Committee purchased about 19,500 tons of coal and 800 tons of coke for use at the Greenwich power station, at a cost of about £43,000, during the quarter ended December 31st, 1917.

The Highways Committee has granted an additional war bonus of 5s. a week (making £1), from December, 1917, to the operative staff at Greenwich power station and the tramways sub-stations. The cost is estimated at £2,400 during the current year and £7,100 during 1918-19.

The Highways Committee has settled 1,034 claims against the Council in respect of accidents in connection with the working of the tramways, at a cost of £7,748; 15 actions were brought against the Council; in six a verdict against the Council was given, and £326 and costs had to be paid.

Norwich.—The time for compulsory purchase of lands under the Norwich Electric Tramways Act, 1914, has been extended by a further period of one year.

Sunderland.—Rate Relief.—The Tramways Committee has decided to allocate £5,000 towards the relief of the rates. The net profit on the year's working amounted to £12,500.

United States.—The Chicago, Milwaukee and St. Paul Railway, which has already electrified 440 miles of its main line through the Rocky Mountains, has placed contracts for the electrification of 220 miles from Othello to the Pacific Coast ports of Seattle and Tacoma. There will be 17 locomotives and 8 sub-stations. The Westinghouse Electric Co. furnishes 7 locomotives and equipment for 5 sub-stations, while the General Electric Co. has the balance of the contract. The sub-stations are spaced 21 to 35 miles apart, and have either one or two motor-generator sets of 2,000 kw., with space for an additional set in each case. They are 3,000-volt continuous-current machines, having a 2,500-k.v.a., 2,300-volt, 60-cycle motor and two 1,000-kw., 1,500-volt, direct-current generators connected in series. Each set can carry 200 per cent. overload for 5 minutes. Two stations will be supplied with 55,000-volt current, while the others will have 102,000-volt current. The line crosses a mountain range, and has three long gradients of in 48, 1 in 62 and 50 miles of 1 in 100 to 1 in 57. Two of the engines are shunting locomotives of 75 tons weight, each carried on a pair of four-wheel bogies. They have a tractive effort of 22,000 lb. The passenger locomotives will have 12 motors, the Westinghouse engines using the quill type of driving gear, and the General Electric engines having a bipolar gearless drive. These locomotives are required to haul trains of 12 steel carriages, or 960 tons, at 25 miles an hour on the ruling gradient of 1 in 48, and at 60 miles an hour on level line. The contract required the first 10 engines to be completed in four months.—*Engineer.*

TELEGRAPH AND TELEPHONE NOTES.

Egypt.—The purchase of the Egyptian telephone system has been fixed at 755,000 Egyptian pounds (£774,661). The Government has taken over the telephone service as from January 1st, and will pay interest at the rate of 5 per cent. until the completion of the purchase. The Council of Ministers has approved of the transaction.—*The Times.*

India.—During the year 1915-16, the telegraph system increased by 3,128 km. of line to 138,567 km., and by 12,376 km. of wire and cable to 543,729 km. The offices open numbered 8,592, including 5,084 railway offices, and the staff 10,756. The traffic amounted to 18,129,748 telegrams, and the receipts were 22,551,486 fr. The telephone system comprised 287 Government exchanges with 8,115 subscribers, and 13 private exchanges with 10,766 subscribers. There were 19 radio-telegraph stations, nine being on the coast; the latter dealt with 83,719 messages. The accounts, on the whole, showed a surplus of 7,222,603 fr.—*Journal Télégraphique.*

London Telephone Directory.—The January edition of the London Telephone Directory, which is now being delivered to subscribers, has been brought up to date by the inclusion in each entry of the number of the postal district in which the subscribers reside.—*The Times.*

Telegraphs and Telephones in 1917.—In the course of a review of 1917, the *Telegraph and Telephone Journal* states that there was a great extension in the working of telegraph lines on the Baudot system, and a considerable further development in multiplex working is in progress. A system for facilitating the disposal of telegrams by diversion was introduced with excellent results, some 15,000 transmissions a day having been saved by this means. This had the effect of relieving the large central offices where the staff was depleted, and giving more employment to smaller and less busy centres. The experimental abolition of the "office copy" has also had the most satisfactory results, effecting a saving of upwards of 50,000,000 forms and at least a million carbons, together with economies in other directions, besides materially lightening the work of telegraphists. On the telephone side, the opening of the new Central Exchange at Manchester marked the completion of a work of considerable magnitude. The exchange system was extended to some dozen towns and villages during 1917. The year also witnessed a considerable extension of the system of handling telegrams over the telephone. In April, Edinburgh and Glasgow were placed on the direct system of trunk working similar to that in force between Manchester and Liverpool and other places. Close upon 550 members of the telegraph and telephone staff alone (including engineering staff) gave their lives for their country during the year.

Wireless Telephony.—At the Point Judith light, near Newport, R.I., wireless telephone apparatus has been installed, to enable the operators to telephone the name of the light to mariners during fog or thick weather. The warning is given by repeating the words: "Point Judith Light" every five seconds, with a limit of range of about eight miles. After every third repetition the warning: "You are getting closer, keep off," is sent out, with a limit of range of about two miles. The signals are received on the ordinary ships' wireless equipment.—*T. and T. Age.*

According to the *South China Morning Post*, the Communications Department of Japan has developed a method of connecting the ordinary telephone with the wireless telephone, so that a message from a ship at sea may be transmitted through a shore exchange to a subscriber. Credit is given to Messrs. Tonegawa and Torigata for the work. It will be remembered that the same feat was accomplished in the United States in 1915.

According to the *Journal Télégraphique*, the number of wireless stations open at December 31st, 1917, was 6,113, of which 687 were coastal stations and 5,338 on board ship, the remaining 88 being inland.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

Adelaide.—February 27th. P.M.G.'s Department. Telephone material. Schedules 479 and 483. See "Official Notices" January 18th

Croydon.—February 18th. Tramways Department. 3, 6, or 12 months' supply of general stores: Tramways Manager, Thorton Heath Depôt.

London.—L.C.C. February 18th. Tramways Department. 4,500 forged steel driving wheel tires, and 3,000 forged steel trailing wheel tires. Manager, L.C.C. Tramways, Belvedere Road, S.E. 1.

Manchester.—February 12th. Tramways Department. General stores, including electric lamps, insulating material, overhead equipment, &c. See "Official Notices" February 1st.
February 13th. Electricity Committee. One 150-H.P. three-phase fan motor and switchgear. Mr. F. E. Huhges, Secretary.

Newport (Mon.).—February 18th. Electricity Department. One 3,000-KW. turbo-alternator and surface condensing plant. See "Official Notices" February 1st.

Salford.—February 11th. Tramways Department. 12 months' supply of general stores. General Manager.

Warrington.—February 26th. Electricity Department. Steam pipework. See "Official Notices" to-day.

CLOSED.

Bexhill-on-Sea.—T.C. 1,000 tons of Shipley peas coal, or Manners' washed peas, for the electricity works: Myers, Rose and Co.

Derby.—T.C. Boiler for the electricity works: Babcock and Wilcox, Ltd., £4,595. Two electric coal wagons: General Vehicle Co., Ltd., £2,810.

Hereford.—T.C. Telpher gas plant, with electric hoist: Herbert Morris & Co., Ltd., £1,884.

London.—L.C.C. Supply of tramway fittings equipment, 1917-18. Additional tenders accepted during the quarter ended December, 31st last:—

Cotton-covered copper wire. Class T.6a:—

London Electric Wire Co., & Smiths, Ltd.—Items 1, 3, and 4, approximate value, £925.
Midland Electric Wire Co., Ltd.—Items 2, 5, and 9, approximate value, £5,740.

Rewinding armatures for tramcars:—

P. R. Jackson & Co.—£476.
Drewer Stevenson & Co.—£224.
British Westinghouse E. & M. Co., Ltd.—£167.
H. Dunn & Son.—£340.
Electrical Repair Co., Ltd.—£360.
Burdette & Co., Ltd.—£315.
Collins Electrical Co., Ltd.—£160.

Field coils for tramcars:—

Manchester Armature Repair Co.
Brush Electrical Engineering Co., Ltd.—(Approximate expenditure, £8,980.)

Swansea.—Electricity Committee. Tender recommended. Turbo-alternator, £15,387: James Howden & Co., Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—(**Dublin Local Section.**)—Friday February 8th. At 8 p.m. At the Royal College of Science, Upper Merrion Street. Ordinary meeting.

(**Students' Section**).—Friday, February 8th. At 7 p.m. At Faraday House, Southampton Row, W.C. Paper on "Magnetos," by Mr. R. W. Corkling.

(**Newcastle Local Section.**)—Monday, February 11th. At 6.45 p.m. At the Mining Institute. Paper on "Telephone Exchange Transfers, and their Organisation," by Mr. F. G. C. Baldwin.

(**Manchester Local Section**).—Tuesday, February 12th. At 7 p.m. At the Engineers' Club. Paper on "Some Transient Phenomena in Electrical Supply Systems," by Prof. E. W. Marchant.

(**Scottish Local Section**).—Tuesday, February 12th. At 7.30 p.m. At 207, Bath Sreet, Glasgow. Visit by the President. Ninth Kelvin Lecture, "Kelvin as a Teacher," by Prof. M. Maclean.

(**Yorkshire Local Section**).—Tuesday, February 12th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Large Batteries for Power Purposes," by Mr. E. C. McKinnon.

Physical Society of London.—Friday, February 8th. At 5 p.m At the Imperial College of Science, South Kensington, S.W. Annual general meeting. Papers on "A Recording Thermometer," by Prof. C. V. Boys, F.R.S., and "The Primary Monochromatic Aberrations of a Centred Optical System," by Mr. S. D. Chalmers.

Royal Institution of Great Britain.—Friday, February 8th. At 5.30 p.m. Lecture on "Science and Ethics," by Prof. E. H. Griffiths, F.R.S.
Saturday, February 16th. At 3 p.m. At Albemarle Street, W. Lecture on "Problems in Atomic Structure," (Lecture I), by Prof. Sir J. J. Thomson.

North of England Institute of Mining and Electrical Engineers.—Saturday, February 9th. At 2 p.m. At Neville Hall, Newcastle-on-Tyne. Ordinary meeting.

Institution of Mining and Mechanical Engineers.—Saturday, February 9th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Ordinary meeting.

Salford Technical and Engineering Association.—Saturday, February 9th. At 7 p.m. At the Royal Technical Institute. Lecture Recital by Mr. J. Crewe, on "The Construction and Tone of the Violin."

Birmingham and District Electric Club.—Saturday, February 9th. At 7 p.m. At the Swan Hotel, New Street. Discussion on "The Decimal System," to be opened by Mr. H. C. James-Carrington.

Society of Engineers.—Monday, February 11th. At 5.30 p.m. At Burlington House, Piccadilly, W. Presidential address by Mr. W. B. Esson, and Presentation of Premiums.

Association of Supervising Electricians.—Tuesday, February 1 th. At 7.15 p.m. At St. Bride's Institute. E.C. Paper on "D.C. Motor Troubles," by Mr. E. F. Butler.

Association of Engineers-in-Charge.—Wednesday, February 13th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "The Place of Economics in Transport and Engineering," by Mr. W. T. Stevenson.

Royal Society of Arts.—Wednesday, February 13th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Relations between Capital and Labour—Reasonable Hours, Co-partnership and Efficiency," by Lord Leverhulme.

Faraday Society.—(Manchester meeting.) Thursday, February 14th. At 7 p.m. At the Municipal School of Technology, Whitworth Street. Discussion on "Electric Furnaces."

Electro-Harmonic Society.—Friday, February 15th. At 6.15 p.m. At the Holborn Restaurant, (Venetian Chamber). Concert (Ladies' Night).

Institution of Mechanical Engineers.—Friday, February 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, February 16th. At 4.30 p.m. At the Royal Technical College, Glasgow. Paper on "Steam Turbines as Applied to Colliery Work," by Mr. P. J. Pliven.

NOTES.

Training Disabled Men.—At a meeting, at Birmingham, of the West Midland Joint Disablement Committee, Alderman James announced that there was a probability of establishing in that city in the near future a large school for training disabled men in electrical engineering. The proposals were for the instruction of at least 100 men.

Institution and Lecture Notes.—Royal Institution.—At the general meeting of the members on the 4th inst., the managers reported that Dr. Mond, under the conveyance and deed of trust of the Davy Faraday Research Laboratory, covenanted to pay to the Royal Institution before the year 1926 the sum of £62,000 as endowment fund. The trustees had anticipated the obligation by eight years, and had transferred the sum of £66,500 in 5 per cent. war stock to the trustees, nominated by the managers, of the Davy Faraday Research Laboratory Endowment Fund. This would add materially to the income available for the purpose of promoting and maintaining the efficiency of the laboratory in the advancement of original research in chemical and physical science.

Bradford Engineering Society.—Last week Mr. Edward Shofton, of the Jowett Motor Manufacturing Co., addressed the Society on the subject of electric vehicles. The lecturer referred to the early history of the electric vehicle, and described modern types; he regretted that many owners did not keep records of running costs, but data available showed that these were generally such as would make the petrol or steam vehicle owner envious. The lecturer also referred to electric industrial trucks for factory use, and mentioned as an example their use at Manningham Mills.

Association of Mining Electrical Engineers.—A meeting of the Yorkshire Branch was held at Wakefield, on January 26th, and discussed a paper by Mr. C. A. Nelson, of the North of England Branch, strongly advocating the application of electrical power for all colliery purposes.

Economise Fuel.—In view of the necessity of reducing the consumption of coal, and the labour and transport required to handle it, Mr. Guy Calthrop, Controller of Coal Mines, desires to draw the attention of all consumers of gas and electricity throughout the country, to the need of the greatest possible economy in their use. These commodities are so easily obtainable, and are, comparatively speaking, so cheap, that few people appreciate the fact that, in the aggregate, many millions of tons of coal are required annually to produce them. There is undoubtedly a very great deal of unnecessary use, and consequent waste, and, if enforced economy is to be avoided, a material reduction must be effected by voluntary action.

He appeals, therefore, to all classes of consumers to take this matter in hand for themselves, and to see that every gas burner and electric switch over which they have control is used as sparingly as circumstances will allow. The need for this economy is accentuated where large cities and towns are remote from coal-fields, as is the case with London and other cities and towns in the South.

Appointments Vacant.—Mechanical engineer (65s. +), shift engineer (63s.), Borough of Leigh (Lancs.) Electricity Department; commercial assistant (£220), for the Stoke-on-Trent Corporation Electricity Department; shift engineer (50s. +), for the Borough of Weymouth Electricity Works; meter tester and repairer (54s.), for the Borough of Colchester Electricity Department. See our advertisement pages to-day.

Novel Electric Ship Proposal.—The Liverpool *Journal of Commerce* recently outlined a proposal by Mr. H. de M. Snell for ship construction on somewhat novel lines. The suggestion is to have one set of detachable power producing machinery for three or more hulls, which would each be equipped with propellers and electric driving motors only, arranged for coupling by cables to the power plant. The power plant is apparently housed in a detachable and floatable poop, which can be continuously employed in propelling one or other of the hulls, and can, in times of stress, be separated from the hull. It is suggested that existing hulls in which the machinery is worn out can be reconstructed on the new system and be further used. No details of the arrangement proposed are, however, given in our contemporary.

Educational.—Examinations in Science and Technology.—The Board of Education has decided to discontinue the general examinations in Science and Technology altogether after 1918. The higher general examinations will be held in that year, with the exceptions specified in Circular 970. The regulations and syllabuses which governed the examinations held in 1915 will remain in force for 1918, so far as they are still applicable.

Association of Teachers in Technical Institutions.—A meeting of teachers engaged in the Technical Institutes, Junior Technical Schools, and Trade Schools of London and neighbourhood was held at the Polytechnic, Regent Street, W., on Saturday last, to consider the question of salaries. There was a large attendance, and in the discussion emphasis was laid on the fact that the salaries paid in institutions of the above-named types compare very unfavourably with those paid in industry and in secondary schools. A resolution declaring that the present rates of salaries paid to both day and evening teachers in technical institutions are totally inadequate, and urging educational authorities to take immediate steps to establish satisfactory scales of salaries for all teachers, was carried unanimously. A further resolution requesting the Government to allocate special grants, similar to those given in the case of secondary and elementary schools, for improving the salaries of teachers in technical schools and institutes was also unanimously adopted. It was agreed that the London Branch of the Association should request the County Councils of London and the Home Counties to receive a deputation to place before them the views of the meeting.

American Engineers and the Forces.—According to the *Electrical Review* (Chicago), the U.S. Engineering Council passed the following resolution in December:—"The Engineering Council, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, recognising the serious responsibility of the engineer for the successful prosecution of the war in the many branches of the national service where highly-trained engineers are required, urges the importance, as a war measure, of maintaining unimpaired the engineering strength of the nation, for the successful prosecution of military operations and for the support of sustaining industries. Since schools of engineering are the principal sources from which trained engineers may be drawn, the Engineering Council urges that in the administration of the selective draft the Government should maintain these schools in full operation, and should take such steps as will enable qualified engineering students to continue their studies to graduation, if possible, and, in any event, until necessity demands their call for active service. This recommendation is made for the sole purpose of ensuring the continuous supply of trained engineers for the future service of the nation."

A Government Trade Mission.—It is announced that Sir H. Llewellyn Smith, Permanent Secretary to the Board of Trade, has undertaken a special mission on behalf of the Government. He is accompanied by Mr. H. Fountain, of the Commercial Relation and Treaties Department, and by Mr. Walter Carter (private secretary), and will be absent from the office for some weeks.

Callender's Hospital and Distress Fund.—A general meeting of this fund was held at the Belvedere works of Messrs. Callender's Cable and Construction Co., Ltd., on February 4th, when the Committee's statement for the year ended December, 1917, was adopted. The report, which is the fifteenth annual statement since the fund was started, shows that the total sum received by penny-weekly subscriptions in the fourth year of war is the highest on record—namely, £321; donations (including £50 from the company and personal gifts from the directors, &c.) added up to £85. Gratuities paid out to members were £79, grants to hospitals, &c., £297. The balance at bank and in hand is £109. The grants to hospitals and institutions at which members received benefit were larger than in any previous year. A large number of hospital letters were issued, and other assistance took the form of special home nursing, surgical appliances, spectacles, convalescent home letters, and financial help.

Tar Oils.—The Minister of Munitions announces in the *London Gazette* of February 1st that the Order of October 23rd, 1917, controlling tar oils is cancelled, and he now takes possession of all tar oil in the United Kingdom, and all dealings in tar oils without a licence are forbidden, except where the quantity purchased does not exceed five gallons per month; but persons who have applied for licences may continue to take delivery of tar oils under existing contracts for fuel to a total amount not exceeding one month's average deliveries. The contract note is to specify the grade and price of the oil with all extra charges, and the price must not exceed a scale given in a schedule, except in the case of contracts entered into prior to July 13th, 1917. Holders of stock must furnish to the Controller of Explosives Supply, Storey's Gate, S.W. 1, particulars of their transactions as directed by him. The term "tar oil" includes light oil, sharp oil, creosote oil, green oil, and anthracene oil, and any other oil produced or containing oil derived from tar, with the exception of crude benzol, naphtha, &c. The schedule gives specifications of the various oils, and the prices, ranging from 90s. 6d. per ton for Diesel-engine oil down to 41s. 6d. for a mixture of creosote oil 25 per cent. and pitch 75 per cent., f.o.r. or f.o.b.

Applications for licences should be addressed to the Controller, Mineral Oil Production Department, Ministry of Munitions, 8, Northumberland Avenue, W.C. 2.

Screw Gauges.—Before the war, the accurate cutting and gauging of screw threads had attracted a great deal of attention, but the progress then being made was a standstill compared with that which has been accomplished during the war, and in this important work the National Physical Laboratory has naturally played a leading part. An enlarged issue of the "Notes on Screw Gauges" prepared by the staff of the gauge-testing department was recently published, which in itself demonstrates the thoroughness and efficiency with which this very difficult subject has been tackled by the authors, and the high degree of perfection which has been attained; the complexity of the matter is well illustrated by the fact that "the Whitworth thread has seven elements, error on any one of which may be sufficient to cause a gauge to reject work which ought to pass, or *vice versa*." These elements are discussed in detail in all their bearings, and the approved methods of making the necessary measurements are explained, with full descriptions of the apparatus employed.

The correct methods of cutting accurate screw threads are also described, and the latest devices for carrying out optical measurements of screw gauges are fully explained, including the projection method, which has been brought to its present pitch of refinement, we believe, entirely at the N.P.L. Even now the elements of ring screw gauges cannot readily be measured in the workshop, and these gauges are generally tested between limits by plug gauges. The brochure is indispensable to anyone concerned with the accurate cutting of screw threads.

Limiting Alternator Short-Circuit Currents.—Under this title in the *Electrical World*, Vol. 70, No. 10, Mr. Ralph Bonn discusses the actions and reactions which take place when an alternator is short-circuited, and shows theoretically, as well as with oscillograms, that the heavy armature reaction induces an electromotive force in the field winding which greatly increases the field current, and thus prolongs the duration of the heavy armature current. In the case of alternators with non-salient poles, very little can be done to reduce the short-circuit current except to introduce series reactance in the armature circuit. With salient poles, however, the course of events can be modified by introducing resistance and inductance into the field circuit. Added resistance shortens the period by dissipating the field energy more quickly, without materially reducing the magnitude of the short-circuit current. Inductance, on the other hand, introduced externally, restricts the increase in the field current, and thus reduces the initial value of the armature short-circuit current. While the experiments were carried out on a laboratory scale only, there may be cases, says the author, where the introduction of inductance into the field circuit to limit the short-circuit current would be good engineering.

The Case for 110-Volt Lamps.—According to J. R. Colville (*Electrical World*), in the U.S.A., glow lamps rated at 110 to 125 volts represent about 85 per cent. of the output of tungsten lamps (vacuum and gas-filled types), excluding miniature lamps. Lamps of the 220 to 250-volt class represent only about 7 per cent. of the factory output, and even this figure would be reduced were it generally realised how great is the total advantage of low-voltage lamps in point of low price, high efficiency, long life, and cheaper fittings-installation. The difference in cost of 110-125-volt and 220-250-volt lamps, based on the contract schedule in force last June, ranges from 2d. per 25-watt vacuum-tungsten lamp bought under a £2,000 contract to 5s. 10d. per 1,000-watt gas-filled lamp bought at list price. Subject to a few per cent. variation, according to wattage, 230-volt lamps cost 20 to 25 per cent. more than 115-volt lamps, and yield only 90 per cent. as much light for equal wattage. The low-voltage type offers fewer manufacturing difficulties, and is made in so much greater quantities, that it is a more highly standardised product, and one in which the latest improvements are more easily incorporated. In a new lighting installation the use of 115-volt lamps, instead of 230-volt units, often saves enough in the cost of outlets, fittings, and accessories to pay for a balancer coil, motor-generator, or other voltage-halving equipment. The annual saving in lamp renewals and energy is then clear profit. In any but the smallest installations it is better policy to use a voltage-halving equipment and 3-wire distribution, rather than run pairs of low-voltage lamps in simple series connection.

Domestic Electrical Appliances in the U.S.A.—The Society for Electrical Development has recently made a rough census of domestic electrical appliances sold by 100 leading manufacturers in the U.S.A. These, it appears, have sold 7,194,792 pieces of apparatus, including over 3,000,000 irons, 1,880,000 fans, 673,000 vacuum cleaners, 241,000 washing machines, 239,000 disk stoves, 122,000 grills, and 114,000 percolators, the balance comprising dish washers, heating pads, teapots, heaters, radiators, ironing machines, chafing dishes, ranges, vibrators, water heaters, griddles, &c.

Standard Electric Lighting Sets for U.S.A. Farm Use.—In view of the increasing trade that is being done in the United States in electric lighting sets for farm use, and in order to ensure that the majority of manufacturers of such sets shall fix ratings on the same basis, the American Society of Agricultural Engineers has recently recommended certain standard ratings and specifications. The pamphlet issued by the Society recommends that 30 volts be adopted as the pressure for low-voltage lighting plants, and that with such sets 16 lead-sulphuric acid cells in series, or 24 Edison cells, be adopted as standard. It also recommends that the manufacturers of farm lighting sets should agree on a standard lamp of a certain voltage range, to be known as the farm service lamp.

Electro-Harmonic Society.—The next concert (Ladies' Night) will be held at the Holborn Restaurant in the Venetian Chamber on Friday, February 15th, commencing at 6.15 p.m. The artistes will be:—Miss Violet Oppenshaw, contralto; Mr. David Ellis, tenor; Mr. Edgar Coyle, baritone; Miss Adelina Leon, violoncello; Mr. Lewis Sydney, humourist at piano; Mr. George Bolton, entertainer at piano; Prof. Anders, conjuror and sleight-of-hand; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist. Chairman: Mr. Llewellyn B. Atkinson.

The A.E.S.E. in Sheffield and District.—A large and representative gathering of engineers met on Wednesday evening, January 30th, at Atkinson's Café, Sheffield, to form a branch of the A.E.S.E. A deputation from Manchester were invited to attend, and included Messrs. Lunn, Pausey, and Thomas, the last-named being secretary for the Manchester branch. Mr. Fedden, general manager and engineer of the Sheffield electric supply department, who took the chair, opened the meeting with some explanatory remarks with reference to the standing of the present-day power engineer and his future position when the recommendations of the Whitley report are carried into effect. Messrs. Lunn and Pausey spoke on the Association of Engineers and the increase of efficiency created by the interchange of ideas that would accrue through being members of the Association. Mr. Thomas gave a general review of the policy of the Association. A resolution was put by the chairman to form a Local Section, and this was carried unanimously. Representatives came from Barnsley, Hull, Leeds, Mexborough, and Rotherham. Apologies were received from several prominent engineers in the district, who were unable to attend.

The Whitley Report.—The Industrial Reconstruction Council has issued a small pamphlet entitled "Trade Parliaments," in which explanatory information respecting the Whitley Report appears. The urgency of the different trades each taking steps to carry into effect the recommendations set forth in the Report is emphasised, and some suggestions are made as to their application. We recommend our readers to apply to the Secretary of the Council, 8, Bouverie Street, E.C. 4, for a copy of the pamphlet.

Keeping Down the Peak Load.—Under the strenuous conditions imposed upon electricity supply undertakings by the war, the importance of keeping down the peak load has greatly increased, and efforts have been made in some cases to induce large consumers to vary their hours of starting and stopping work, lunch times, &c., so as to improve the diversity factor and keep the load off the peak, with fair success. In the *Electrical World*, Vol. 20, No. 22, some particulars are given of the working of this policy in a district where a number of new industries connected with the emergency shipbuilding programme of the U.S.A. Government have been established, throwing unprecedented loads on the power station. While the tramway and private lighting loads could not be modified, all power users taking over 50 H.P. were interviewed, and only two out of the first 266 that were visited were unable to co-operate with the supply undertaking in this way; by arranging an earlier closing hour with some 24 consumers, 2,600 KW. was taken off the peak. Where large numbers of men were employed, instead of all the employés leaving the works at the same time, arrangements were made for them to leave in batches at half-hour intervals, thus smoothing out both the power and tramway curves, and diminishing the congestion on the tramways. This policy has to be applied with discrimination, lest, for example, the release of a large number of workers just before the peak should produce a greater increase in the tramway load than the amount of the power load cut off; but it is evident that when carefully carried out the plan is well worth adoption where shortage of plant renders the height of the peak a serious consideration.

Generating Steam with Electrical Energy.—The Swiss Society of Steam Boiler Owners has carried out tests on the commercial possibilities of generating steam with electricity derived from water power. A small boiler was used with 38 steel tubes, in 34 of which were placed heating coils. An evaporation of 2½ lb. of water per sq. ft. of heating surface was obtained, and the efficiency was 90 to 91 per cent. To compete with coal in Switzerland, at 44s. per ton, the cost of energy would have to be not more than ·08d. per unit.

Owing to the scarcity of coal, which now costs over £3 a ton and is likely to reach £4, the working of the Swiss railways is costly and difficult, and the feasibility of using electric heating on steam locomotives is being seriously considered. While the complete electrification of the railways cannot be accomplished at present, the supply of electricity to the locomotives would present less difficulty, and the cost of energy from water power would be only 0·15d. per unit, which would be comparable with the cost of coal. In view of the possibility that the supply of coal from Germany may be completely stopped, the subject is of some importance to the railways, which would have no alternative in such an emergency.

Plant for Disposal.—Barrow-in-Furness electricity department is inviting offers for one 500-KW. D.C. steam generator and one switchboard panel. Full particulars are given in our advertisement columns to-day.

Municipal Electric Vehicle Costs.—Some tabulated data have recently been published by the *Surveyor* on the subject of costs of municipal electrical vehicle working, which is based on information supplied to the Weymouth Corporation. The following is of interest:—South Shields (two Edisons), 2s. 9d. per t.m. electric, 4s. 5½d. per t.m. horse, six horses replaced; Ipswich (one Orwell), 1s. 1½d. per t.m. electric, 1s. 9d. to 2s. per t.m. horse, three horses replaced; Leyton (one Edison), probably a saving of 2d. per mile by electric, 2½ horses replaced; Dover (six Edisons), 1s. 8d. per t.m. electric, 2s. 9½d. per t.m. horse; Ilford (one Edison), 9½d. per t.m. electric, 1s. 2d. per t.m. (by contract) horse, four horses replaced. It may be noted that the wages paid, and number of helpers, vary very much with the locality. General haulage is carried out at Ipswich and coal haulage at Ilford, otherwise the vehicles are employed in refuse removal. The vehicles run from 2 to 4 tons capacity, and, with one exception, are fitted with power tipping gear. The price of electricity for battery charging varies from 1d. to 1¾d. per unit. With one exception the various authorities record their view that the electric vehicle is more satisfactory than the horse for short journeys. At Ipswich it is considered that the horse is more economical for journeys of 2½ to 3 miles.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending February 16th, 1918, by Lieut.-Colonel C. B. Clay V.D., Commanding.

Officer for the Week.—Lieut. C. E. Campbell.
Next for Duty.—Lieut. W. J. A. Watkins.

Monday, February 11th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, February 12th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, February 13th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, February 14th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, February 15th.—Musketry, 5.30—8.

Saturday, February 16th.—Knotting, &c., for the whole corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Special Notices.—All drills will take place at Headquarters, unless otherwise stated.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Notes from Spain.—Our special contributor in Spain sends the following:—Madrid's lighting problem through coal shortage has been made more difficult by the specially dry winter, the output from the hydro-electric plants falling very much below normal, one fall (Bolarque) being practically useless. Such low water in January has not been known for many years past. The rainstorms at the end of the month have now improved matters. According to the Commission of Supply, 600 tons of coal are used daily in the production of electricity for Madrid. The Commission suggests that during the absence of public street lighting, house owners should fix small lamps outside their houses, and has promised a reduction of rates to house owners doing this.

The price of gas in Seville has been raised to ·55 peseta per cb. metre—about 12s. 3d. per 1,000 ft.

The Spanish Government has ordered that all Spanish boats of more than 500 tons must be fitted with complete wireless installations by the end of July, 1918.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Manchester Electricity Supply Committee recommends the following increases of salary in the electricity department:—MR. A. E. MACKENZIE, deputy chief engineer, from £750 to £850 per annum; MR. F. E. HUGHES, secretary, from £500 to £550; MR. H. C. LAMB, resident engineer, Stuart Street Station, from £500 to £600; MR. W. E. FODEN, accountant, £450, to be appointed financial superintendent and statistical officer at £550 per annum; MR. E. BOLTON, sub-stations engineer, from £450 to £500. The Tramways Committee recommends that the salaries of tramway officers be increased as follows:—MR. JAS. WOOD, financial superintendent and assistant manager, from £600 to £750 per annum by three annual increments of £50 each; MR. J. T. OAKES, traffic superintendent, from £500 to £600 per annum by two annual increments of £50; MR. F. A. MITCHESON, accountant, from £400 to £550 per annum, by three annual increments of £50; MR. G. R. BLACKBURN, from £400 to £500 per annum by two annual increments of £50 each; MR. D. G. MALLALIEU, permanent way superintendent, from £350 to £400 per annum.

The Sydney (N.S.W.) City Council has been recommended to vote £250 to MR. S. Y. MALING, deputy general manager of the Corporation electricity undertaking, in recognition of his services as acting general manager during the absence of Mr. H. S. Forbes Mackay (general manager) in America, and for the satisfactory discharge of the heavy responsibilities devolving upon him during the period of the recent strike.

The Aylesbury T.C. has appointed MR. BUNDOCK as works manager at the electricity works.

The Gloucester T.C. has increased the salary of the electrical engineer and general manager of the light railways (MR. CORSON) from £500 to £600 a year.

The Loughborough Corporation Electricity Committee has granted MR. R. B. LEACH, the borough electrical engineer, an advance of £50 per annum in salary, and expressed high appreciation of his services.

General.—MR. J. M. JACKSON, secretary of the Record Electrical Co., Ltd., has been granted leave of absence to join an officers' cadet unit of the R.F.C.

The *Times* announces that Mr. John Hodge, M.P., has appointed

SIR C. H. KENDERDINE, K.B.E., a Director of Artificial Limb Supplies in the Ministry of Pensions.

On January 26th, at Holy Trinity Church, Brompton, the marriage was solemnised of MR. RALPH H. CRIDGE, B.Sc. (Eng.), Lond., of Electro-Metals, Ltd., and Miss Lilian A. Storr, B.Sc. (Hons.), Lond., late senior mathematics mistress at the Girls' High School, Burnley.

On February 7th, at Brompton Oratory, Kensington, MR. ARTHUR JOHN GREENLY was married to Caro Fantini, third daughter of Mrs. E. M. Fantini, of Putney, S.W.

Roll of Honour.—CORPL. H. J. H. CLARK (23), Royal Warwickshire Regiment, formerly on the staff of Messrs. Vaughton, electricians, of Birmingham, has been awarded the Military Medal. He held "a bombing step on the right flank of an isolated company for 22 hours, inflicting numerous casualties on the enemy."

PRIVATE JAMES BRIXEY, Rifle Brigade, an employé of Messrs. A. P. Lundberg & Sons, has been awarded the Military Medal for devotion to duty in holding the lines of communication under shell fire.

LIEUT. D. S. BADDELEY, Motor Transport Corps, who has been in France for over two years, has been decorated with the Order of the Crown of Belgium and the Croix de Guerre Belge. Mr. Baddeley is representative for Messrs. Crompton & Co., Ltd., for Scotland and the North of Ireland.

SERGEANT W. WILLIS, London Regiment, has been awarded the Military Medal for holding an advanced trench in spite of repeated counter-attacks, the position being held for 36 hours, although Sergeant Willis was wounded in the back. He was at one time in the employ of Burnley Corporation tramways department, afterwards taking up a position with the Torquay Corporation tramways.

The death in action is reported of LANCE-SERGEANT ROBERT G. CASTOR, L.N.L. Regiment, who was employed by Messrs. Dick, Kerr & Co., of Preston.

ARTHUR THOMAS, who joined the Army whilst an electrician at the Port Talbot steel works, has died in Mesopotamia from double pneumonia.

WIRELESS OPERATOR A. C. PEGGS, of Leigh, Southend-on-Sea, has been drowned through the sinking of the vessel on which he was the operator.

PRIVATE LEWIS PARSLOW, South Wales Borderers, who was for 17 years with Messrs. E. T. Mackrill & Sons, electrical engineers, of Aylesbury, has died from pneumonia whilst on active service.

The employés of the Leeds tramway department serving in His Majesty's Forces have in all been awarded 13 distinctions, consisting of one Distinguished Service Order, four Distinguished Conduct Medals, and eight Military Medals.

Twenty-five per cent. of the employés of Messrs. A. Reyrolle and Co., Ltd., joined up at the commencement of the war. Ten of these have been the recipients of the following honours and promotions:—Honours: James Taylor, Quartermaster-Sergeant, Military Cross; G. Huskisson, Lance-Corporal, Military Medal; J. Kellett, Reg. Sergeant Major, Meritorious Service Medal; R. W. Laine, Sergeant, Mentioned in Dispatches. Promotions from the Ranks:—Five others have been made Captains and one a Lieutenant.

PRIVATE G. HYHAMS (London Regiment), formerly in the Special Sales Department of the India-Rubber Co., Cannon Street, E.C., died of wounds in Egypt.

PRIVATE H. FENNELL (Middlesex Regiment), who was in the Experimental Department of the India-Rubber Co., Silvertown, was wounded recently.

Obituary.—The death has occurred of MR. WM. HENRY CLARKE, who had for 13 years held a position at the Newport (Mon.) Corporation electricity works. He was 32 years of age, and had invented an anti-aircraft shell which had passed the Inventions and Research Committee.

NEW COMPANIES REGISTERED.

Cass's Motor Mart, Ltd. (149,466).—Private company. Registered January 29th. Capital, £2,000 in £1 shares. To take over the business carried on at 5, Warren Street, St. Pancras, as Cass's Motor Mart, and to carry on the business of motor and electrical engineers, agents, and dealers, &c. Agreement with L. E. Cass & E. R. Cass. The subscribers (each with one share) are:—E. R. Cass, 414, Archway Road, N. 6, engineer; L. E. Cass, 287, Archway Road, N. 6, engineer. The first directors are:—E. J. Cass (permanent director and chairman), L. E. Cass, and E. R. Cass. Registered office: 5, Warren Street, St. Pancras, N.W.

Accumulators (Birmingham), Ltd. (149,465).—Private company. Registered January 28th. Capital, £5,000 in £1 shares. Manufacturers of, and wholesale and retail dealers in, accumulators for lighting and starting motors, motor cycles and cars, aeroplanes, airships, engines of all kinds, house lighting, and other electrical plants, &c. The subscribers (each with one share) are:—W. H. M. Burgess, 40, Glasshouse Street, W., merchant; H. J. Prockter, The Gables, Lingfield, Surrey, architect. Permanent directors: W. H. M. Burgess and H. J. Prockter. Remuneration, £200 each per annum, free of income-tax. Registered office: 36-40, Glasshouse Street, Piccadilly Circus, W. 1.

Blackhall Engineering Co., Ltd. (9,993).—Private company. Registered in Edinburgh on January 24th. Capital, £12,000 in 11,775 ord. shares of £1 each and 9,000 def. shares of 6d. each. To purchase an option, and to adopt and carry into effect an agreement between J. H. Ballantyne, J. Wotherspoon, and L. Mackie, and to carry on the business of electrical and general engineers, &c. The subscribers (each with one share) are:—Thos. M. Ross, 4, Wellside Drive, Cambuslang; Robt. N. Hall, 28, Kenmoch Street, Glasgow. The first directors are:—J. H. Ballantyne and J. W. Wotherspoon. Solicitor: J. L. Mackie, 62, St. Vincent Street, Glasgow.

Mica & Micanite Supplies, Ltd. (149,471).—Private company. Registered January 28th. Capital, £1,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are:—R. Keedwell, 183, Croydon Road, Anerley, S.E. 20, clerk; G. E. T. Stebbing, 33, Rosebery Road, S.W. 2, law clerk. The first directors are to be appointed by the subscribers. Registered office: 3, Great Winchester Street, E.C.

Fortluminium, Ltd. (149,446).—Private company. Registered January 24th. Capital, £10,000 in 9,500 ord. shares of £1 each and 10,000 deferred shares of 1s. each, to establish and develop the aluminium alloy known as "fortluminium." The subscribers (each with one deferred share) are:—J. T. Lane, Heatherdale, Woodford, engineer; F. R. Rand, 38, Victoria Street, S.W. 1, railway contractor; C. Vautin, Salisbury House, London Wall, E.C. 2, metallurgical engineer. The first directors are:—F. R. Rand and J. T. Lane. Qualification, 2,500 deferred shares. Remuneration as fixed by the company. Solicitor: J. B. Willis, 59, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Blackpool, St. Annes & Lytham Tramways Co., Ltd.—Memorandum of satisfaction in full on October 30th, 1917, of debentures dated 1905-13, securing £20,000 has been filed.

Elieson Electric Traction Co., Ltd.—Debenture dated January 18th, 1918, to secure £225 and further advances up to a total of £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. P. Elieson, 24, St. Mary Abbotts Terrace, Kensington, W.

Birmingham District Power & Traction Co., Ltd.—Trust deed dated January 7th, 1918, to secure £40,000 second debenture stock (with power to issue further stock ranking *pari passu* to an amount not exceeding £200,000), charged on the company's present and future assets (subject to prior debenture stock, of which £454,890 has been issued). Holders: Electrical & Industrial Investment Co., Ltd., Kingsway, W.C.

Bastian Electric Co., Ltd.—Particulars of £2,000 debentures created September 3rd, and secured by trust deed dated November 12th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908. None of the debentures have been issued at present. Property charged: Leasehold hereditaments comprising first, second, and third floors of 185, Wardour Street, W., and the company's other assets, present and future, including uncalled capital. Trustees: R. H. Forman and R. G. Warner.

Amazon Telegraph Co., Ltd. (44,532).—Capital, £250,000 in £10 shares. Return dated December 11th, 1917. All shares taken up; £250,000 paid. Mortgages and charges: £245,100.

Chilean Electric Tramway & Light Co., Ltd. (57,203).—Capital, £1,150,000 in 500,000 ord. and 650,000 pref. shares of £1 each. Return dated January 11th, 1918. All shares taken up; £650,000 paid on the pref.; £500,000 credited as paid on the ord. Mortgages and charges: £308,000.

Burmah Electric Tramways & Lighting Co., Ltd. (75,090).—Capital, £200,000 in 20,000 ord. and 20,000 pref. shares of £5 each. Return dated January 2nd, 1918. All shares taken up; £100,000 paid on the pref; £100,000 considered as paid on the ord. Mortgages and charges: Nil.

Caerphilly Electric Supply Co., Ltd. (139,086).—Capital, £6,000 in 400 cum. pref. shares of £5 each, and 1,500 pref. ord. and 2,500 ord. shares of £1 each. Return dated December 31st, 1917. 100 ord. shares taken up, subject to payment wholly in cash, but nothing called up thereon. Mortgages and charges: Nil. (Owing to war, the company has not commenced trading, and therefore no call has been made on the directors in respect of their qualification shares.)

Bullers, Ltd. (62,020).—Capital, £400,000 in 20,000 ord. and 20,000 pref. shares of £10 each. Return dated December 19th, 1917. 15,000 ord. and 15,000 pref. shares taken up; £150,070 paid on seven ord. and 15,000 pref.; £149,930 credited as paid on 14,993 ord. Mortgages and charges: Nil.

Robert W. Blackwell & Co., Ltd. (63,446).—Capital, £50,000 in £1 shares. Return dated January 14th, 1917. All shares taken up; £18,338 paid on 18,338 shares; £31,662 considered as paid on the remainder. Mortgages and charges: Nil.

CITY NOTES.

Dublin United Tramways Co., Ltd.

The report shows the amount available for division at £96,226. The interim dividend in August absorbed £23,400, leaving £72,836. From this a preference dividend of 6 per cent. for the half-year, and a final ordinary dividend of 5 per cent. are recommended. £15,000 is set aside for renewal of rails, £7,000 is added to general reserve, and £11,500 is written off investments, bringing them approximately to their present market value. £13,461 is to be carried forward. The total receipts from passenger traffic were £353,839, against £319,612 in the previous year; the passengers carried were 66,624,326, against 60,448,121, and the mileage run was 7,732,897, compared with 7,372,606.

The annual meeting was held in Dublin on Tuesday. Mr. WM. M. MURPHY, who presided, referred to the re-issue of £39,400 debenture bonds, and to the fact that stockholders were being given the preference in subscribing for them. They were sometimes told by public men how much better the municipality could manage those tramways than the company did, and how much more profit they could make for the ratepayers than the company paid as wayleaves and for upkeep of streets. He was inclined to think, however, that the citizens knew at least that the tramways would be no burthen on the rates while they owned and worked them. Except for the increase in traffic they would have had a poor showing for the past year. He found that, while the gross receipts had increased since 1912 by £51,100, the working expenses in the same period had increased by £78,503—in other words, the net profits were £25,397 less in 1917 than

in 1912. This was not good enough. The dividend of 4½ per cent. on the whole year, reduced from 6 per cent. which they used to pay, was not an adequate return to those who provided the money to establish the undertaking. The inadequacy of the profits was more apparent when it was remembered that the various local authorities had the option of acquiring by purchase the tramways in their respective districts within less than 20 years; and it was necessary they should not only get a fair interest, but that they should build up a reserve faster than they had been doing to meet any deficiency in the purchase price. They had hitherto relied on the increase of traffic to meet the increased expenses, but an increase of fares seemed to him the only way in which they could retrieve their position in face of the ever-growing working costs. There were certain fares fixed by statutory authority, but there were others which could be raised, especially on overlapping stages. The cost of electrical operation had increased by £5,376, of which £4,511 was due to the advance in coal price and to coal freights. Unlike British tramway managers, they had been able to get men for all their traffic requirements. With the addition of £15,000 to the reserve for rail renewals, they would have over £75,000 in hand to start with when they next got a supply of rails. He mentioned, in conclusion, the successful carrying through during the year of the change of capital from shares into stock, the advantages of which, he said, were obvious. With regard to a discussion at the Dublin Corporation on the company supplying electricity for power for Admiralty work at Alexandra Dock, Mr. Murphy said the fact was they did not wish to give the supply, but the correspondence showed that the Government authorities believed the Corporation could not give it, and issued a Realm Act Order to the Tramways Co. to do so.

Paris Supply Companies.

The report of the *Société l'Eclairage Electrique* for 1916-17 states that the growing requirements for the national defence induced the company further to develop the production of war material. At the request of the Ministry for War new manufactures were undertaken, and the works, particularly those at Lyons, assumed considerable importance. On the other hand, large extensions were made at the works in the Rue Lecourbe, the Avenue de Choisy, and the Rue Bolivar and Jarville. The company also participated in the reorganisation of the manufacture of porcelain at the works of Sainte Foy l'Argentière, in order to ensure the delivery of materials which were procured from enemy countries before the war. A considerable share was also taken in the capital of the Société des Applications Industrielles, it being regarded of great interest to become connected with an electrical trust for the development of activity after the war. The accounts show net profits of £190,000, as compared with £146,000 in 1915-16. After placing £99,000 to the legal and special reserve funds, the balance has permitted of the payment of a dividend of 12s. per share, this contrasting with 10s. in the previous year.

The Société d'Electricité de Paris, which owns the large station at Saint Denis, reports that the use of electrical energy in 1916-17 for motive-power purposes expanded beyond all prevision, although the financial results were far from corresponding with this progress. The supply branch was relatively at a disadvantage. Everybody applied to it, and sales increased, but, as the prices paid by consumers were limited by long-term contracts or by specifications, they did not compensate for the formidable rise in the cost of raw materials. The uncertain quality of the coal, and the almost complete lack of finished manufactures for repair work caused the machinery to be submitted to severe trials. It was advisable to renew the machines which were beginning to get obsolete, in order to reduce the consumption of coal. Such renewal was projected before the war, when the price of coal was 16s. to £1 per ton, and it was all the more desirable now, when coal was about quintupled in price. It was impossible, however, to obtain large sets within a convenient period, and the company was compelled to postpone most of the renewal programme owing to the enormous prices demanded by engineering firms, the difficulty of procuring metal manufactures, and the scarcity of labour. Nevertheless, it was none the less necessary to put to reserve the sums which the replacement would absorb, and which would be greater than had been foreseen years ago, when the renewal fund was established, as pre-war prices could not be expected to be seen again for several years to come. It was, therefore, prudent to strengthen the renewal fund, and thus permit of the installation at a fitting opportunity of the most modern types of boilers and turbo-alternators, and therefore enable the great Saint Denis works to maintain its position. The total sales amounted to 154,630,000 KW.-hours, as compared with 116,824,000 KW.-hours in 1915-16, and 145,350,000 KW.-hours in 1913-14, which latter was the previous year's maximum since the starting of supply in 1905-06. After providing for the interest on the loan debt, and placing £20,000 to the renewal fund, the accounts show net profits of £102,000 on an ordinary share capital of £1,000,000, which sum has allowed of the payment of a dividend of 8 per cent., being the same rate as in the preceding year. The renewal fund, with the present allocation, has now reached a total of £320,000.

The directors of the *Compagnie d'Electricité de l'Est Parisien* (*Est Lumière*), reporting on the year 1916-17, state that the company suffered from the inadequacy and excessive wear and tear of the plant, the difficulty of obtaining machinery and raw materials, and the dearness of the latter, particularly coal. The development projected before the war had been delayed, and although the assistance of adjoining stations had been obtained, the supplies of energy received from them were far from being of the regular character which had been hoped for. New boilers had been ordered capable of furnishing 20,000 kilogrammes of steam per hour at a cost of £32,000, and these would probably be put into operation in the spring. It was now intended to order a large turbine and further boilers for an output of 30,000 kilos. of steam per hour. The number of consumers, both for light and power, experienced a further increase, and amounted together to 60,259 at the end of the financial year, representing a connection of 539,000 lamps and 26,900 KW. for motive power users. The total receipts amounted to £430,000, as compared with £284,000 in 1915-16, but as the working expenses totalled £444,000, as against £273,000, a loss of £14,000 was incurred. The main cause of this state of affairs lay in the price of coal, which was £3 18s. 5d. per ton during the year. Every effort was made to counteract the effects of the high price of coal. In the case of industrial consumers, these had agreed in future to pay per KW.-hour according to the variation in the price of coal. Negotiations had been begun with the lighting consumers and small-power users, and with the 25 towns served by the company, with the object of securing higher prices. In the case of the towns an arrangement had been made, and was now only awaiting the approval of the superior authorities, whereby a provisional increase with retroactive force from April 1st, 1915, would be introduced, starting from coal at the price of £1 14s. 3d. per ton. The debit balance for the year, which has been carried to a suspense account, amounts to £56,000, and is composed of the before-mentioned loss, plus interest charges, interest, and redemption of loans and premiums on loan securities drawn for redemption. This position compares with a deficit of £25,000 in the previous year, which was extinguished by drawing upon the special reserve fund.

Yorkshire Electric Power Co.

In their report for the year ended December, 1917, the directors give the following particulars:—Net profit after payment of mortgage and other interest:—1915, £21,209; 1916, £29,112; 1917, £33,258, plus £3,866, making £37,124 available. After paying 6 per cent. on the preference shares, and 5 per cent. on the ordinary, £12,000 is transferred to general reserve, carrying forward £4,392. The company continues to make substantial progress, and the dividend (5 per cent.) compares with 3 per cent. for 1916. There have again been material increases in the cost of labour and supplies. In November, 1916, a turbo-alternator of 6,000 KW. was put on load, and an additional machine of the same output has been ordered, and is now being erected.

To meet the cost thereof, and of considerable extensions to the company's plant and mains in the southern portion of the area of supply, the Ministry of Munitions have agreed (in addition to the £60,000 mentioned in the last annual report) to lend to the company further amounts not exceeding £122,000, which will be secured on the plant and mains so erected.

Agreements have been made to give a bulk supply to the Spenborough and Elland U.D. Councils, and to Electrical Distribution of Yorkshire, Ltd., for supply in the urban districts of Featherstone, Garforth, Horbury, Otley, Penistone, Rawdon, Selby and district, and Stanley; supply to these undertakings of the Distribution Co. will not be commenced until after the war.

The buildings, plant and mains of the company have been maintained out of revenue.

The demands for electrical energy have been heavy during the past year, and large developments in various parts of the company's area are being made, which will call for further supply from the company's mains.

To enable these developments to be dealt with the directors have secured a site at Ferrybridge, near Knottingley, on which to erect a generating station with large units of plant. The position of this site is shown on the plan attached to this report.

Of the issue of £71,640 of 6 per cent. cum. pref. shares authorised in September, 1916, £52,890 has been taken up to the end of the year, leaving £18,750 available.

The sinking fund, providing for the redemption in 1937 of the debenture stock of the Yorkshire Waste Heat Co., now amounts to £5,542.

Kalgoorlie Electric Power and Lighting Corpn., Ltd.

Owing to war delays it may not be possible to hold the general meeting until July, but from information received it is calculated that the net income of the past year will be nearly £4,000 below that received in 1916.

This large decrease is mainly due to the shortage and the refractory attitude of labour, which, with other causes, prevented the mines from producing the usual tonnage of ore, thereby lessening the demand for electric current. There has also been a further increase in the cost of all supplies, which is another factor in lessening the profit for the year. These disadvantages have been most markedly conspicuous during the last quarter of the year, the cabled returns indicating a reduction in receipts of some £1,400 compared with the corresponding period of the previous year. In view of the smaller profit and of the arrangement entered into with the debenture holders to appropriate the first profits made during the current year, to the amount of £7,500, for a further repayment to them, the directors have decided that they will not be justified in paying the usual dividend to the preference shareholders in April next. It is hoped that when the obligations to the debenture holders have been provided for there will be a sufficient balance of profit remaining to enable the directors to recommend the payment of a dividend.

The debenture debt has now been reduced to £30,000, therefore, though the payment of dividends is for the time being suspended, the position of the shareholders is improved. It is expected that in four years the whole of the debenture debt, which is the only prior charge, will be repaid, and then the entire sum of distributable profit will be available for dividend to the shareholders.

Oriental Telephone & Electric Co., Ltd.—The directors are issuing a circular to their shareholders announcing that the Telephone Co. of Egypt, Ltd., has accepted an offer from the Egyptian Government for the purchase of its undertaking

at a price of £755,000. The purchase has been approved by the Council of Ministers. The details of the contract are under discussion, and as soon as it has been signed further particulars will be published. After the payment of the debentures of the Egyptian Co. and the liquidation of all other claims upon that company, almost the whole of the net proceeds will belong to the Oriental Telephone & Electric Co., Ltd., which owns practically the whole of the shares in the Egyptian Co. The application of such proceeds is under consideration, and proposals will in due course be submitted to the shareholders.

Metropolitan Railway Co.—Results for 1917:—Gross railway receipts £1,166,414, expenditure £745,928, miscellaneous receipts £190,196; total net income £610,682, plus £14,492 brought forward. Interest, rentals, and other fixed charges and appropriation to renewals absorb £305,314; dividends on preference stock, £239,107. Dividend on the ordinary stock £1 per cent. for the year, leaving £16,101 to be carried forward. £20,000 has been put to general renewals fund.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended November 30th, 1917, amounted to 2,479,429, compared with 2,366,060 in the corresponding five weeks of 1916.

National Gas Engine Co., Ltd.—Final dividend 3¾ per cent., and bonus of 1s. per share, on the ordinary shares, making 12½ per cent. for the year, free of tax.

St. James's & Pall Mall Electric Light Co., Ltd.—Balance dividend of 3s. 6d. per share on the preference (7 per cent.) shares, and 5s. 6d. per share on the ordinary, making a total of 9 per cent. for the year.

STOCKS AND SHARES

Tuesday Evening.

Lombard Street has marched into the area of financial politics once more as a live consideration by reason of the cheapness of money. Although the discount rate is maintained at 3½ per cent., there is what the market calls "money over" almost every evening, and this is having its effect upon short-dated securities as well as upon investment stocks as a whole. At the same time, there is not much business doing. Naturally, the economic and Labour situations in Germany are being watched with the keenest interest. For, although strikes are not unknown over here, they assume much greater importance in Germany by reason of the contrast which exists between the two countries in the way of freedom of speech. Therefore, the investor waits, and in the meantime puts as much money as he can spare into one or other form of Government borrowing.

The home railway market has slipped into a condition which approaches the parlous. Those who have maintained their faith in it for a long time past, begin to yield to the feeling that there is nothing to go for, and that the obvious uncertainties attached to Labour possibilities after the war is over, outweigh the good rates of return which many of the stocks pay at current levels. Therefore, prices are dull, and, although the argument does not apply to electrical companies with anything like the same force as its does to the steam railways, the one reacts upon the other. The abolition of halfpenny fares on the 'buses cannot fail to have a favourable effect upon the takings, and in the Underground issues, the Central London assented stocks are all 2 points up. Rumours are afloat as to a possible taking over by the London General Omnibus Co. of one of the smaller 'bus concerns, and details are expected to be made public in the course of the next few weeks.

The electric supply shares are a good market, and rises have occurred this week in St. James's and Westminster to 7¼ and 6¾ respectively. Westminster's increased dividend making 9 per cent. against 7 per cent., is a strong bull point. Other quotations are also better than they look, although no quotable alterations occurred. There is a good deal of activity in Edison Swan shares, and, although each successive rise is met by a certain amount of profit-taking, the shares offered are readily absorbed, and the market shows considerable resiliency. The £5 shares stand at 2⅞, and the £1 shares, in which most of the speculative interest is centred, have hardened to 33s. British Westinghouse Preference, which generally move in sympathy with Edisons, remain at 56s. 3d., and it would appear as though there were a few shares to be realised on the part of those who got in some months ago when the amalgamation-of-interests idea was first mooted, and who have been fidgeting to get out of their shares because the price did not immediately respond.

South Metropolitan Ordinary are wanted at 22s. 6d., and the demand has served as a reminder that the company's relations with the County of London Electric Supply may materialise into still closer association sooner or later.

Marconis are once more on the move, and the parent shares advanced to 62s., which is, of course, ex the dividend recently declared. Americans are a rather better market at 24s. 9d., although in their case the price is held in check by the fact that there remain a good many speculators who bought them when they were extensively tipped in Stock Exchange circles, and who are waiting for an opportunity to get out at good prices. Other members of the Marconi group attract little attention, but the market seems to be a firm one generally.

Oriental Telephones have risen no less than 7s. 6d. to 3½, on the expectation that the Egyptian Government will take over at a very good price the part of the company's undertaking situated in Egypt. Chile Telephones maintain their recent improvement. West India and Panama further spurted, this time to 36s. 3d., and the reason for the advance is still somewhat obscure. Some are hoping for an increase in the dividend; others profess uncertainty whether the sixpence a share will be repeated this time. Eastern Ordinary is a point to the good. The Anglo-American group keeps very steady.

Brazilian Tractions have been up to 46, and at 45½ they still retain a rise of 1½ on the week. Anglo-Argentine Trams are firm, with another small recovery in the first preference shares. Nothing fresh has occurred to disturb the dulness of Mexican and Canadian Utility companies' issues.

Castner-Kellners have jumped to 3 9/16, a gain of 5s., due to the impression that the shares had been overlooked in the recent buying movement of other chemical descriptions. British Insulated ordinary are also 5s. better at 3½, there being a pronounced shortage of supply. Telegraph Constructions are really harder, although the nominal price remains at 42. Engineering varieties are mostly good, and the armaments have also taken a turn for the better. Rubber shares continue dull and out of favour, the price of the raw material keeping buyers out of the share market. Base-metal mines are strong, with the Cornish tin and Broken Hill groups very much to the fore.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1916.	Price Feb. 5, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref.,	4½	4½	3⅞	—	6 13 4
Chelsea	4	3	3⅝	—	5 4 4
City of London	8	8	12½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅜	—	5 18 6
County of London	7	7	11½	—	6 5 10
do. 6 per cent. Pref.	6	6	10⅜	—	5 18 6
Kensington Ordinary	7	6	12	—	6 11 7
London Electric	3	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	11	— ½	5 18 6
Metropolitan	3	3	6½	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8½	—	6 13 4
St. James' and Pall Mall ..	8	8	7¼	+ ¼	5 10 4
South London	5	5	8	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6¾	+ ¼	6 11 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	5	6	94 xd	—	6 7 0
do. Def.	23/6	1½	2 xd	—	6 13 4
Chile Telephone	6	6	7½	—	5 10 4
Cuba Sub. Ord.	6	7	9½	—	*7 11 4
Eastern Extension	8	8	15½	—	*5 6 0
Eastern Tel. Ord.	8	8	151½	+ 1	*5 5 7
Globe Tel. and T. Ord.	7	7	14½	—	4 19 1
do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	22	24	95	—	6 11 6
Indo-European	13	13	51½	—	6 6 6
Marconi	10	15	2⅛ xd	—	4 16 1
Oriental Telephone Ord. ..	10	10	6½	+ ½	3 17 2
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Pan.	6d.	6d.	1½	+ ¼	*2 15 2
Western Telegraph	7	8	15½	—	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	64½	+2	6 4 0
Metropolitan	1	1	21½	— ½	4 9 0
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A" ..	Nil	Nil	1/8	—	Nil
do. do. Income	6	4	8 ½	— ½	4 18 2
Foreign Trams, &c.	Dividend 1916.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	47	—	6 3 1
Anglo-Arg. Trams, First Pref.	6½	6½	2⅝	+ ⅛	—
do. 2nd Pref. ..	6½	—	2⅜	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	45½	+1½	—
Bombay Electric Pref.	6	6	9 xd	+ ½	6 6 4
British Columbia Elec. Ry. Pfce.	6	6	48	—	11 12 4
do. do. Preferred	Nil	Nil	19½	+1	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	63	+2	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	83½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	88	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	23	—	6 12 4
British Aluminium Ord. ..	7	10	13½	—	5 0 9
British Insulated Ord.	17½	20	35	+ ½	5 14 4
British Westinghouse Pref. ..	7½	7½	21⅜	—	5 6 9
Callenders	20	20	15	—	6 13 4
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 9/16	+ ½	5 12 2
Edison Swan, fully paid ..	—	—	2⅜	+ ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	14	—	6 13 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	18	18	19	—	6 5 3
Henley	25	25	17	—	7 7 1
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14½	—	*6 15 7
Telegraph Con.	20	20	42	—	*5 14 3

* Dividends paid free of income-tax.

MIDLAND RAILWAY ELECTRICS.

An interesting article recently appeared in our contemporary, the *Commercial Motor*, on the subject of electrics in railway service.

This article deals particularly with electric vehicles put into service by the Midland Railway Co., which has really pioneered in the use of the "electric" on a commercial scale for railway goods and parcel delivery, just as it has pioneered in many other directions of railway work.

For many years past, says our contemporary, this company has been deliberating upon the motorisation of its street traffic as a whole. Elaborate data have been collected, and during 1914 the preliminaries were completed, and all was ready for the launching of the new scheme; it only remained

30-cwt. "Edison" Parcel Van.

to ascertain how far the data were supported by practical applications. The company had to decide between three competing types of power vehicle, operated by steam, petrol or oil, and electricity respectively, and it chose the latter.

In June, 1915, the introduction of a number of 30-cwt. parcels "electrics" and lorries of its own, following on trials during the previous Christmas season of similar vehicles in the Metropolitan area, decided the company, and at the moment it owns a fleet of 76 electric vehicles, which are operating in London and several provincial towns. Not only the Midland, but other companies who have studied the results, are awaiting a decided reduction in the cost of the vehicle before going further, says our contemporary.

The Midland Co. operates 21 petrol vehicles as well as some steam-driven ones, but experience has shown that the electric

2-ton "G.V." Goods Lorry, with Ironclad-exide Battery.

alone is able to fulfil the duty for which it has been selected, to the best advantage, *i.e.*, that of eliminating the horse.

For city and town work, so far as it affects railway use, the electric has things all its own way; it accelerates quickly, and is able to take advantage of breaks in the moving traffic in a way which the petrol vehicle, with its change-speed gear, cannot do.

A test of petrol and electric vehicles of similar capacity, starting side by side from rest, showed that the latter travelled over 80 ft., while the former covered only 60 ft., and it is this ability to speed-up in the short gaps of crowded street traffic which constitutes its advantage, even over the petrol vehicle under such conditions. Our readers may recall that the celerity with which the "electric" can get away constitutes its chief recommendation for fire-brigade use, and that it has proved its superiority beyond doubt under such conditions. The railway in question has proved this in another manner. There was at one time a considerable volume of traffic flowing between Woolwich and St. Pancras, and both petrol and electric vehicles were employed in the service, the former having a speed rating of 20 m.p.h., as against the 12 m.p.h. maximum of the latter; yet the running time between the two showed no appreciable difference, proving conclusively that the petrol vehicle is deprived, owing to street congestion, of its high turn of speed, while the electric, on the other hand, profits from its lower maximum rating and more rapid acceleration.

Even in moving bulk loads between two points there is a minimum distance at which the petrol is inferior to the electric vehicle.

At Sheffield the railway depôt is situated in a basin: four electrics, two 2-tonners and two 3½-tonners respectively are doing satisfactory service on the hilly routes.

2-ton "Detroit" Goods Lorry, with Edison Battery.

The inflated cost of petrol is not such a serious factor in the cost of using the petrol vehicle with the Midland Co., as it is able to produce a fair proportion of its own liquid fuel from the manufacture of gas for railway carriage lighting, and at a cheap rate.

The main fact, however, is the striking displacement of horses; in the London area some of the lighter electric vehicles are doing work which formerly required the combined effort of six horses, and the Metropolitan costs are showing a good saving as a result of the conversion.

The operation of the electric vehicle, as is well known, can

Midland Parcel Electrics under Charge.

be mastered by the average man in a few hours, and this is a distinct advantage to the railway staff making the change, as the withdrawal of railwaymen for the special training required by drivers of petrol vehicles would dislocate the ordinary routine work, and skilled men from outside would, on the other hand, have to learn the railway business.

Railway deliveries fall into two broad classes, *i.e.*, personal passenger baggage or parcels, and merchandise sent by goods train. The Midland Co.'s experience points to 3½-ton elec-

tric vehicles as best suited for goods traffic; if a standard vehicle were required. The company's London traffic now employs 54 electrics, viz., 15 15-cwt., two 1-ton, and nine 1¼-ton parcel vans for passenger traffic; also 15 2-ton, seven 3½-ton, and six 5-ton lorries for goods traffic.

Our contemporary publishes the accompanying table, setting forth the average annual costs of maintaining and working the electric vehicle fleet of the Midland Railway, during 1916, the figures including all charges except wages of drivers and attendants.

	Lead battery.		"Edison" battery.				Petrol.
	2-ton.	3½-ton.	2-ton.	3½-ton.	30-cwt. parcel van.	15-cwt. parcel van.	25-cwt.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Current (or petrol)	33 10 0	45 0 0	42 0 0	56 0 0	25 0 0	11 10 0	99 0 0
Tires	22 10 0	32 0 0	22 10 0	32 0 0	16 5 0	6 8 0	17 0 0
Repairs	20 0 0	25 0 0	20 0 0	25 0 0	16 0 0	9 11 0	40 15 0
Maintenance, including battery attention	11 0 0	12 0 0	10 0 0	11 0 0	4 6 0	4 6 0	15 10 0
Oil and stores	2 0 0	2 0 0	2 0 0	2 0 0	1 5 0	1 5 0	5 5 0
Standing charges	140 0 0	165 0 0	125 0 0	156 0 0	102 0 0	63 0 0	40 0 0
	£229 0 0	£281 0 0	£221 10 0	£282 0 0	£164 16 0	£96 0 0	£217 10 0
Cost per mile...	5·73d.	6·74d.	5·3d.	6·76d.	3·95d.	4·61d.	5·2d.

Wages are eliminated because the drivers belong to either the general superintendent's, or goods manager's staffs; moreover, the wages item is a variable factor, as a man, a man and a boy, or two men may be employed, while sometimes two shifts are worked, the vehicle being in service for 20 out of 24 hours. Similar charges would be incurred with steam or petrol vehicles.

For purposes of comparison, the working cost of a 25-cwt. petrol vehicle is also included; the level of cost is not due to inflated fuel charges, as the fuel is assessed at 2s. per gallon, and, as a rule, petrol vehicles have longer runs than electrics.

For the electric vehicles, energy for battery charging averages 1d. per unit; and no difficulty is experienced in covering the 10,000-mile tire guarantee. The figures represent the first year's experience of the company with electric, and more attention was given to overhaul, &c., than is now regarded as really necessary; also considerable expenditure was incurred in making good damage due to accidents which occurred in congested railway goods yards. Mechanical repairs are insignificant as a rule.

The standing charges are inclusive of interest, depreciation, or provision for renewal of the chassis, body, and battery; battery figures are based on manufacturers' guarantees, and as regards lead batteries, which are guaranteed for two years, experience points to decreased rather than increased charges.

The company is giving an extended trial to the Edison and lead batteries, and, so far as circumstances allow, the two are being run side by side, and carefully compared. The company's experience is that the Edison battery, while having a longer guarantee and life than the lead battery, is at a disadvantage where current is relatively dear; wherever the company can purchase energy at less than 1d. per unit, the former holds the advantage. Moreover, the Edison battery requires less attention, and its useful life being longer it avoids some of the trouble which may arise at more frequent intervals towards the end of the shorter life of the lead batteries. But the company's experience shows that there is little to choose between the two types, and the table shows but little difference in operating cost.

This table is based on a 10,000 mileage, but this was exceeded by two of the parcels vans, one of which covered 18,000 miles during the year; it is also anticipated that the 2-tonners engaged in goods service will exceed the total. For battery charging at the depôt, there is merely a plug and flexible connection either to a wall fitting or to one sunk in the ground, the energy being metered on the vehicle.

Some of the smaller vehicles in London cover 50 miles a day on one charge, and put up a weekly running record of 200 miles. Our contemporary points out that there are many who will persistently maintain that a large proportion of the work which is being fulfilled by electrics can be carried out by petrol-driven machines. But the Midland Co. has the records of its fleet of 21 petrol vehicles, which have been run on an equally systematic basis, and with a distinct advantage as regards liquid fuel, as electrical energy from the available generating station is charged at the prevailing price, yet the company declares that "the figures, more especially as regards total cost per annum, are distinctly in favour of the electrics. The costs per mile are also in favour of electrics, notwithstanding that the petrol mileage is very much higher than that of the electric in most cases. It should, of course, be understood that the electric and petrol machines come into competition in the same field only to a limited extent, though electrics in comparison with petrols show more favourably all round under present conditions than is normally the case.

Charging Electric Vehicles at the Midland Depot, St. Pancras.

It is generally agreed that the petrol vehicle scores in moving from point to point under full-load conditions over an appreciable distance, but the company maintains that electrics also show favourable results under such circumstances, and for moderate distances they consider them equal to the petrol vehicle. "For such work they would gain by being geared for speeds appreciably higher than those for which they are customarily fitted, and might require somewhat larger batteries in consequence of these high speeds."

The main point at issue, however, is whether the electric vehicle is the most suitable one to displace the horse, and under the conditions of railway delivery work in streets, the petrol machine has proved unsuitable. The high petrol consumption for the distances traversed upon a horse round, the stops and delays in traffic, the heavy wear and tear, combined with the necessity to perform the greater part of the round upon low and intermediate gears, are against the petrol vehicle.

However, as our contemporary rightly suggests, the petrol enthusiasts, far from decrying the electric, should welcome it as a mean of transforming slowly-moving street traffic into something better, which will in the end serve to benefit all motor-driven vehicular traffic.

In conclusion, we are indebted also to the chief mechanical engineer's department of the Midland Railway Co. for the accompanying views, and for their kindness in scrutinising the data contained in the article.

Japan's Electrical Industry.—Since war broke out the Japanese manufacturers of incandescent lamps have developed their export trade rapidly; in 1916 the value of their lamps exported was £67,000, and in 1917 it was estimated at £250,000. Just before the war lamps were not exported, but imported to the value of £30,000. Large up-to-date factories have been erected, and labour is exceedingly cheap.—*Electrical World.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Fractionating Hydrocarbons.

Leon E. Hibt, of Los Angeles, Cal., has patented an apparatus for fractionating hydrocarbon oils, in which the oil to be fractionated is subjected to the action of an electric arc within a closed furnace or retort, in which a controllable pressure may be maintained. Hydrogen in some form or other suitable agent is present in the retort, the reaction between the hydrogen and the oil taking place under the heat of the arc. The oil vapours thereby produced are conducted away and condensed. Referring to fig. 1, the fractionation takes place in the furnace or retort chambers designated 3, 4, and 5. Positive pressure of any desired degree can be created within the chamber by regulating the discharge of the vapours to the offtake 7. In the form of apparatus shown, the ingoing oil is preheated in the chamber 8 to a high degree, since the temperature of the outgoing vapours will be high, depending upon the rate at which oil, either atomised or as a vapour, is fed in. The outgoing temperature can thus be held between 600 and 1,500° F. The oil will therefore be discharged into the furnace chamber

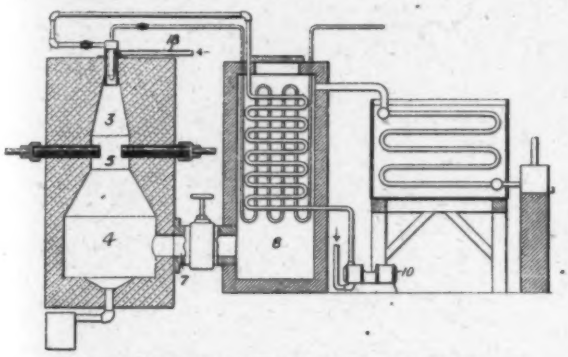

Fig. 1.—Diagram of Fractionating Apparatus.

largely in the form of a vapour, and any unvaporised oil will be atomised by the action of the superheated steam passing through the nozzle. The pump 10 will maintain the oil pressure at the desired intensity, and as the oil and steam pass the arc, the oil is partly broken up and fractionated. The steam introduced with the oil becomes more or less dissociated, the nascent H_2 so formed entering into the reaction with the oils, and by providing the requisite pressure in the furnace chamber, any desired thermo-chemical compound of the oils can be formed. The O_2 liberated combines with carbon to form CO gas; this is preferable to carbon in the free state, since the latter clogs up the furnace and discolours the condensed fractions. Free chlorine gas may be introduced with the oil, or oil and steam, to unite with the carbon and form carbon tetrachloride, which can be recovered and used as a cleaning compound. Bromine gas may also be added either with or without steam. The halogen gas may be inserted through a pipe, as indicated at 18.—*Met. and Chem. Engineering.*

The Electrical Precipitation of Dust.

The Cottrell process of precipitating the fine dust carried by gases is operated with a unidirectional current of from 40,000 volts to 100,000 volts, which is derived from alternating current and rectified by means of mechanical rectifiers or commutators. Standard apparatus has been developed by the Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa.; for this purpose motor-generator sets are generally supplied. The current generated is 60-cycle, single-phase, and can be adjusted from 110 to 250 volts by means of a field rheostat. Standard capacities are 15, 25, 40 and 75 K.V.A.

The transformers are made in standard sizes of 15, 25, 40 and 75 K.V.A. for 60 cycles and 10 K.V.A. and 20 K.V.A. for 25 cycles. Standard high-pressure voltages are 40,000, 60,000 and 100,000. Each transformer has five standard low-voltage taps, giving 50, 62½, 75, 87½ and 100 per cent. of full voltage respectively. Full rated capacity is obtainable on each tap. Careful protection against static surges has to be provided; each transformer has a small oil-immersed choke coil mounted within the case between the end turns and the high-voltage windings, and transformers for over 50,000 volts have in addition choke coils mounted outside the case on each of the high-pressure terminals. Condenser-type terminals are also used on transformers for 50,000 volts and over.

Receiver for Submarine Sound Signals.

German patent rights have been granted to Dr. E. F. Huth (Berlin), for the receiver for submarine sound signals shown diagrammatically in the accompanying sketch, fig. 2. The novelty in this receiver, which is claimed to possess unusual capabilities of tuning and freedom from interruption, consists in the provision of a special resonator between the body exposed to the sound waves travelling through the water (*e.g.*, the hull plates of a ship) and an independently mounted receiving device (*e.g.*, a microphone). The resonator does not touch the hull plate and is capable of being tuned. The coupling between resonator and hull plate *a* is varied by altering the distance between them. The natural frequency of

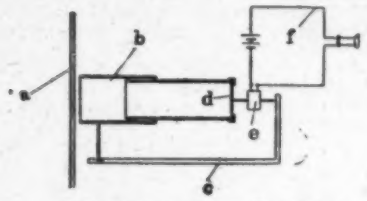

Fig. 2.—Section of Receiver.

the resonator may be varied by sliding the tube *b* to and fro. When the tuning is correct, a weak received impulse sets up oscillations subject to very slight damping. These set in motion the diaphragm *d*, which is coupled mechanically to a microphone *e* in the receiving telephone circuit *f*.

Heating Long Tubes Electrically.

The accompanying illustration shows a method employed to harden steel tubes 15 ft. long. A is an asbestos-lined box, and by sending a low-voltage current through the tube B it was an easy matter to get the required heat. The lever C on the left operated the clamps on top and bottom of the tube. When the required heat was reached the tube was dropped in an oil tank that was sunk in the ground. The only difficulty we had was to keep the oil cold, but this could be easily overcome if production warranted. One great advan-

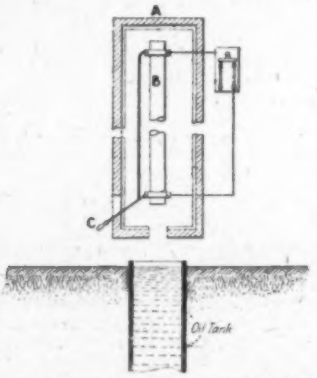

Fig. 3.—Electric Heating Device for Tubes.

tage of this method was that the tubes were heated uniformly throughout their entire length.—F. T. Schell, in the *American Machinist.*

LEGAL.

Liability for Tramway Passengers' Luggage.

Judge T. P. Perks has given judgment, at the Leeds County Court, in a case in which £10 17s. 7d. was claimed for a parcel that had been lost from a Leeds tramcar on which the plaintiff was a passenger. It was stated that plaintiff placed a parcel, weighing between 16 lb. and 18 lb., on the rear platform of the car, and paid the conductress 1d. for carriage. A few stages later on the journey the conductress informed the plaintiff that the parcel had fallen off the car some distance away. The car was stopped, and a search was made for the parcel, but no trace of it could be found. The plaintiff's solicitor argued that the Corporation were bailees for the purpose of carrying the parcel for reward, and that there had been negligence on the part of the conductress.

The Conductress, in evidence, denied that she gave the plaintiff a ticket for the parcel or received any payment for it.

Mr. Clifford Dunn, from the Leeds town clerk's department, who appeared for the Corporation, said that a passenger travelling on the tramways might take with him personal luggage not exceeding 28 lb. in weight without any charge being made for carriage, the responsibility resting with the passenger. It would appear, however, that the parcel in question was merchandise, and although his contention was that no charge had been made, the defendants had no right to carry it free, as it was not personal luggage. The tramways were not common carriers, and had not the liability that common carriers had.

His Honour held that the plaintiff had not proved that the parcel was paid for as merchandise. On the other hand, the evidence showed that the conductress had not been guilty of negligence. He therefore returned a verdict for the defendants.

BRITISH THOMSON-HOUSTON CO., LTD., *v.* DURAM, LTD.

(*Continued from page* 107.)

THE hearing of the appeal in this case continued during last week in the House of Lords. The whole of Tuesday (January 29th) MR. WALTER was reading evidence. He said the trial Judge had held the appellants' patent invalid for want of subject-matter. That was a decision which must, if it were to stand, have been arrived at on evidence that the Judge had before him, and was entitled to give weight to. He hoped that when the evidence had been considered *seriatim*, the House would agree with his submission that there was no such evidence at all, and therefore the ruling that the patent was invalid was erroneous, and must be reversed. The learned counsel had not nearly finished dealing with the evidence from this standpoint when the further hearing was adjourned.

On January 31st MR. WALTER concluded his argument. He submitted that there was no evidence upon which the Courts below could hold that the patent was invalid for the reason alleged by the respondents. He dissected the evidence given at the trial, and then went on to deal in detail with the specification. He argued that it disclosed a perfectly good patent, and the Courts below were in error in thinking that the whole "patent" consisted in working the tungsten metal bar when hot. If that were the crux of the "patent," he should not be there to support its validity, because it was common knowledge that metal could be worked when at a certain heat that was unworkable at a lower temperature. The specification must be read as a whole, and, so read, disclosed a perfectly good patent.

MR. COLEFAX, K.C., followed on the same side.

MR. TERRELL, K.C., for the respondents, began by showing what was common knowledge with regard to tungsten at the time that the patent was granted in 1906. After the respondents had put in an amended defence they, to avoid inspection of their works, made a formal admission on the issue of infringement in these words:—"The defendants formally admit for the purposes of this action that they in the course of their manufacture of tungsten wire subject the metal tungsten in a coherent form to the action of heat while it is being operated on or manipulated." This admission, counsel stated, followed precisely the words of the first claim of the appellants' specification. Therefore, the alleged invention claimed in the specification was in respect of ductile or malleable tungsten for whatever purpose it was to be used.

To that claim the defendants pleaded (1) that the alleged invention was too wide and general, and that there was no subject matter for a patent disclosed, having regard to the common knowledge of metallurgy in general and of tungsten in particular; and (2) that the invention described and claimed had been anticipated. It was so wide that it could include any manner of working, whether by forging, hammering, rolling, or drawing coherent tungsten (however obtained in a coherent form and at any degree of temperature) "while it was being operated upon" in any manner. In short, all the specification consisted in was an alleged discovery that tungsten could be worked hot. The fact that tungsten could be made coherent by many methods was common knowledge all the time. Therefore the specification involved no invention such as was required to support a patent in law.

MR. KERLY, K.C., followed on the same side, and addressed the House also on February 4th and 5th.

MR. WALTER then replied on the whole case.

(To be continued.)

Electricity Direct from Coal Gas.—S. Albert Reed, of New York City, in patent No. 1,225,175, discloses an electrolytic cell which amounts substantially to the production of electricity direct from coal gas. The principle of the method is to dissolve in an electrolyte of fused borax the oxide of a metal such as manganese, which forms easily two or more oxides of different degrees of oxidisation, and readily passing from a lower to a higher degree of oxidisation when in contact with air, and from a higher to a lower when in contact with a reducing agent, such as fuel gas. When the solutions of a higher and a lower oxide are brought into liquid contact at any point, a difference of electrical potential results, and if an appropriate electrode is immersed in each of the solutions a current of electricity will pass in a conductor joining them, so long as the difference of oxidisation respectively in the two solutions is maintained. The E.M.F. obtained when the electrodes are of platinum, and the metallic oxide in solution is an oxide of manganese, is approximately 1 volt, and current is furnished at the rate of 15 amperes per sq. ft. of active surface and upwards.

In a heated chamber is placed a shallow dish of refractory earthenware, within which there is contained a smaller shallow dish of similar material forming a reduction chamber. A tube for supplying fuel gas is led into the inner chamber, and vent holes are also provided for the products of combustion. The electrodes are placed in the inner and outer portions of the borax electrolyte containing the separate forms of manganese oxide. So long as fuel gas is supplied to the tube the normal differentiation of the two oxides is maintained, and a current flows continuously through the circuit. The oxygen which oxidises the fuel is actually supplied electrolytically from the air taken up at the outer extended surface, such air being present inside the heated chamber.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

1,148. "Apparatus for testing setting of cams in igaition magnetos." A. F. MARSH & L. SELBY-WALLIS. January 21st.

1,172. "Transmitting keys for electric telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. & V. A. SMART. January 21st.

1,219. "Renovation of interiors of electric battery dry cells." W. J. THORROWGOOD. January 22nd.

1,220. "Renovation of electric battery porous pots." W. J. THORROWGOOD. January 22nd.

1,242. "Electrical thermal vaporiser." D. G. MACMILLAN & J. P. B. O'REILLY. January 22nd.

1,246. "Railway traffic-controlling apparatus." MCKENZIE, HOLLAND AND WESTINGHOUSE POWER SIGNAL CO. January 22nd. (U.S.A., January 22nd, 1917.)

1,275. "Electric lamp socket." J. R. HANSFORD. January 22nd.

1,277. "Electric starting and lighting systems for automobiles." J. BETHENOD. January 22nd. (France, August 11th, 1917.)

1,301. "Incandescent electric lamps." A. MACCALLUM. January 23rd.

1,313. "Electric accumulators or storage batteries." F. HORNBY. January 23rd.

1,315. "Apparatus for electroplating articles having holes." PLATT BROS. AND CO. January 23rd.

1,318. "Telephonic apparatus." A. L. WILSON. January 23rd.

1,321. "Lamps or lanterns for aircraft." H. C. BROWN & FULLER ACCUMULATOR CO. January 23rd.

1,328/1,330. "Railway signalling." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. AND UNION SWITCH & SIGNAL CO. January 23rd.

1,329. "Railway train-controlling systems." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. AND UNION SWITCH & SIGNAL CO. January 23rd.

1,333. "Swing bracket for electric lighting." W. J. REVELL. January 23rd.

1,359. "Self-generating electric power plant." J. DITCHFIELD. January 24th.

1,361. "Electric incandescent lamps." R. WHIPP. January 24th.

1,376. "Cooling dynamo-electric machines." ENCLOSED MOTOR CO., H. C. E. JACOBY & P. A. H. MOSSAY. January 24th.

1,377. "Step-by-step receivers working on the principle of magnetic gearing." BARR & STROUD AND C. D. MACGILL. January 24th.

1,387. "Ignition system." SPLITDORF ELECTRICAL CO. (U.S.A., May 19th, 1917.) January 24th.

1,399. "Electrical incandescent lamps." G. LAYTON. January 24th.

1,402. "Telephone receivers and transmitters." J. W. FERRIER. January 24th.

1,407. "Electric igniter for combustion motors." K. JAGGI. January 24th. (Switzerland, January 24th, 1917.)

1,430. "Electric fuses." B. THOMAS & E. THOMAS. January 25th.

1,440. "Brush connections for electric motors and dynamos." F. DAY. January 25th.

1,468. "Electric resistances." G. ELLISON. January 25th.

1,483. "Magneto motor." D. SUCHOSTAWER. January 25th.

1,493. "Machine switching telephone systems." L. POLINKOWSKY AND WESTERN ELECTRIC CO. (Western Electric Co., U.S.A., partly.) January 25th.

1,531. "Transmitter diaphragms." F. L. HOTT. January 26th.

1,539. "Electric attachment plugs." BRYANT ELECTRIC CO. & W. HUNT. January 26th.

1,540. "Electric lampholders." A. P. RUTHERFORD. January 26th.

1,567. "Plunger type brush-holder with pivoted head." A. H. BENNETT AND PHŒNIX DYNAMO MANUFACTURING CO. January 26th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

14,422. COMBINED PUMPS AND ELECTRIC MOTORS. Submersible & J. L. Motors, Ltd., & C. W. Durnford. October 10th, 1916. (112,287.)

14,423. ELECTRIC MOTORS. Submersible & J. L. Motors, Ltd., & C. W. Durnford. October 10th, 1916. (112,288.)

14,849. TYPE OF GLAND FOR PASSING ELECTRIC CABLES THROUGH BULKHEADS OR DECKS. J. H. Collie. October 19th, 1916. (112,289.)

18,552. APPARATUS FOR ADVANCING THE SPARK IN INTERNAL-COMBUSTION MOTORS. Soc. Anon. Pour l'Eclairage Electrique des Vehicules. September 9th, 1916. (Addition to 17,934/16.) (109,781.)

18,611. ELECTRIC ACCUMULATORS. I. Chkliar. December 29th, 1915. (102,976.)

1917.

38. METHOD AND MEANS FOR AUTOMATIC ELECTRIC CONTROL OF PETROL-ELECTRIC TRANSMISSION VEHICLES. P. F. Smith & V. S. Robinson. January 2nd, 1917. (Cognate application, 1,095/17.) (112,306.)

90. ELECTRIC LAMP OR OTHER VACUUM TUBE HAVING A COPPER LEADING WIRE. T. Yanai, G. Ohtani & S. Yago. January 26th, 1916. (103,648.)

368. APPARATUS APPLICABLE FOR ELECTRIC LIGHTING. Sir W. G. Armstrong, Whitworth & Co. and A. S. Cheetham. January 8th, 1917. (112,330.)

619. ARRANGEMENT OF THE IGNITION CHAMBER OF TWO-CYLINDER AND MULTI-CYLINDER INTERNAL-COMBUSTION ENGINES. J. G. Sandwall. February 10th, 1916. (103,985.)

2,407. STARTING INTERNAL-COMBUSTION ENGINES. J. J. M. H. Kluijtmans and A. M. H. Gardham. February 19th, 1917. (112,343.)

2,475. ELECTRIC SWITCHES. T. McLeod. February 20th, 1917. (112,344.)

3,486. ELECTRIC WELDING OR FUSION-DEPOSITION OF METALS. Quasi-Arc Co. and W. L. Coles. March 9th, 1917. (112,353.)

5,528. ELECTRIC INCANDESCENT LAMPS. S. Yuyama. April 19th, 1916. (105,764.)

6,023. ELECTROPHONES. S. M. Hyman & Stols Electrophone Co. April 28th, 1917. (112,366.)

7,557. TERMINAL FOR ELECTRIC CONDUIT. F. I. Johnson. February 14th, 1916. (111,834.)

10,072. ELECTROLYTIC ANODES. Electrolytic Zinc Co. July 26th, 1916. (108,311.)

10,588. CONTACT MAKERS AND INTERRUPTERS OF IGNITION SYSTEMS. W. J. Mellersh-Jackson (Philips Brinton Co., U.S.A.). January 4th, 1917. (Divided application on 177/17.) (112,391.)

11,035. ELECTRIC CIRCUIT CONTROLLERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) July 31st, 1917. (112,393.)

14,430. MAGNETO-ELECTRIC IGNITION APPARATUS. Akt. Ges. Brown, Boveri et Cie. October 31st, 1917. (111,100.)